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THE DIAGNOSIS OF POSTERIOR HERNIATION OF THE LUMBAR INTERVERTEBRAL DISKS*

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IT IS common knowledge that there is considerable difference of opinion in the medical profession concerning the methods and efficiency of the treatment of posterior protrusions of the nucleus pulposus from ruptured lumbar intervertebral disks. Underlying this there is an even greater divergence of views about the criteria that must be met before diagnosing this condition.

In a recent group of papers, Magnuson[1] points out that a fine differential diagnosis is necessary in low-back cases and that the recent neurosurgical approach to this diagnostic problem, which has been made "mainly from this standpoint of root pressure from a ruptured intervertebral disk, . . . , seems much too narrow." He points out that variations in the size of the intervertebral foramens and local joint disease cause the low-back pain and associated sciatica that is generally ascribed to disk herniations. He also makes the important statement that it is always possible through an incision in the annulus to curette or otherwise bring out the material that forms the disk, and he is much opposed to incising the intact annulus as part of an exploration for a suspected disk. Larmon[2] offers substantiating evidence from anatomic dissection. Caldwell[3] discusses spondylolisthesis and spondylolysis as frequent causes of low-back pain, either alone or associated with sciatica, and holds that a compressed root is usually the cause of such symptoms and that it is the decompression of the involved root that is the significant therapeutic procedure. Dandy[4] has evolved a so-called "concealed disk" that he claims may afflict all the lumbar intervertebral spaces. He appears to believe that the diagnosis of herniation of a lumbar disk presents no problems. In patients with this disease he states that the history is almost pathognomonic, that the localization is perfectly simple and certain, that diagnostic intraspinal injections are not only unnecessary but ineffective in over two thirds of the cases and that lumbar puncture is needful only if the presence of a tumor of the spinal cord is suspected. It appears, however, that such disks are so well concealed that they can be demonstrated only during operation, and that the indications for surgical interference are the broad ones of an operable patient with a sore back and pain in the leg. Keegan[5] contends that single nerve roots compressed by herniated disks cause dermatomic hypalgesia that is accurately diagnostic of the location and level of the lesion. He states that a conservative attitude should be taken in their treatment because in many early cases improvement occurs without intervention. French and Payne[6] report 8 cases — to which I can add 1 of rupture of the third lumbar disk, included in the series reported below — of tumorlike compression of the cauda equina by a herniated disk. All his cases as well as the one from my clinic had a complete or virtually complete dynamic subarachnoid block with a high cerebrospinal-fluid protein level and symptoms of cauda equina, rather than of single root, involvement. There was a long history in every case (five years in mine), and there was every reason to suppose that the surgery that was eventually made available would have been more successful had the diagnosis been made and treatment instituted much earlier in the course of the disease. Oppenheimer,[7] on the basis of roentgenologic experience and a study of the literature, has evolved the term "discogenic disease" to cover a wide variety of signs and symptoms, including pain at all levels of the spine and associated with recurrent attacks of pain in the arm and leg. He makes the statement that disk lesions are about twice as frequent as duodenal ulcer. In contrast to this, Breck, Hillsman and Basom[8] found that 15 per cent of applicants for heavy work at the plant in Texas where the survey was made had to be rejected because of disease of the lumbosacral spine. This was demonstrated in 450 consecutive pre-employment roentgenograms made in patients without backache either at the time they were seen

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or previously. Finally, Shinners and Hamby[9] make the statement that claim adjusters of at least one insurance company are known to discourage compensation patients disabled by protruded intervertebral disks from seeking surgical relief, and there is certainly a well-founded but undocumented belief that other insurance companies, members of industrial accident boards and of the medical departments of the Army and Navy and many members of the civilian medical profession regard the diagnosis of herniation of a lumbar intervertebral disk with considerable skepticism until the weight of evidence in its favor is overwhelming.

My experience has led me to believe that the clinical diagnosis of a posterior herniation of the nucleus pulposus of a ruptured lumbar intervertebral disk that is based only on the history and physical and neurologic examinations, if unconfirmed by other objective findings, is at best only a "possible" one. Such a low level of accuracy is certainly not ideal. Moreover, even if greater accuracy were possible and the means used to obtain it were safe, it would still not be in the best interests of the patient to advise operative interference on this basis in the usual case and in the absence of an emergency, nor could one expect the patient to accept such advice without demur. Indeed we should scarcely be willing to do so ourselves. The continued search for a substance that visualizes these lesions with a reasonable degree of accuracy and that is simple and safe, as well as the continued use of admittedly unsatisfactory mediums designed for this purpose, emphasizes the general recognition by the medical profession of the need for improvement in diagnostic accuracy and their distrust of unconfirmed clinical criteria. It is the primary purpose of this paper to present evidence to support this contention. Secondarily, I wish to make a brief preliminary report on a new substance to be used for visualization of the lumbar subarachnoid space that so far has met all the requirements noted above. This substance is 20 per cent Skiodan.

So far as I am aware, the best statement of the requirements that must be met before a clinical diagnosis of posterior herniation of the lumbar disks can be made is that published by Bradford and Spurling.[10] More recently Love[11] has also listed essentially the same requirements. They comprise a history of trauma or of unusual strain to the back, with subsequent intractable backache or sciatic pain, or both. The back pain usually precedes the leg pain. The pain is said to be intermittent and not relieved by the ordinary therapeutic procedures. On examination the spinal muscles are spastic, spinal motion is limited and painful, and the straight-leg-raising test is positive. Neurologic signs are often minimal. They include absence or diminution of one Achilles reflex and variable areas of altered sensation in the affected extremity. Bradford and Spurling state that the latter occurs in 75 per cent of the cases examined and that numbness and paresthesias in the lateral aspect of the leg and foot are frequent. They also differentiate a herniation of the fourth and the lumbosacral disk by the distribution of the sensory loss, especially with reference to the great and other toes, and by changes in the ankle jerk. They lay great stress on the jugular-compression test and the effects on the pain of coughing, sneezing or straining, as well as the diagnostic conclusions that may be drawn from these findings. It is generally recognized that herniations may occur at any level of the lumbar spine and may be multiple. Bradford and Spurling, as well as Love, advocate the use of contrast mediums as an aid to diagnosis, but the former writes, "There has been unwarranted emphasis on the difficulty of recognizing clinically cases of herniated nucleus pulposus," and the latter states, "In the majority of cases . . . the diagnosis can be accurately made on the basis of the history and physical findings."

Material

In an attempt to verify these statements, I have analyzed two parallel series of cases in which the history and physical findings might be generally considered to justify a diagnosis of herniation of a lumbar disk. In one series of 78 cases a herniation was proved to have been present by operation and by pathological examination of the removed material in all but 3 cases, which had unmistakable and characteristic myelogram deformities. The comparable series was made up of 41 cases with the following diagnoses: suspected ruptured intervertebral disk, 13 cases (proved negative by operation in 10); compressed root from a small dural envelope or local scar or resulting from a fractured lumbar vertebra, 19 cases (in 14 of which the diagnosis was verified by operation); questionable radiculitis, the cause of which was not apparent, 4 cases (verified by operation in all); a congenital defect without other demonstrable disease, 2 cases (verified by operation in both); and back strain, 3 cases (verified by operation in 1). Of 9 cases listed above as not having been verified by operation, an abdominal aortic aneurysm was visible by x-ray in 1. There was a negative myelogram in this case. In 1 case there were four negative myelograms; operation was not performed in spite of a so-called "typical history." In 1 there was an unquestionably positive myelogram and operation was offered but refused. Five patients had had herniated disks previously removed elsewhere, only to have the symptoms recur in from four to eleven months thereafter. In 2 of these cases the myelogram was positive (abnormal but not characteristic of herniation), and in 1 it was negative. All 5 patients are awaiting re-operation. The last patient had a suggestive clinical history and examination and a questionable myelogram and has refused operation.

Analysis of Results

Age and Sex Incidence

Table 1 shows the age and sex distribution in each series. The latter was about the same in both series. Furthermore, 85 per cent of the proved herniation cases occurred between the ages of twenty and fifty, compared with 83 per cent for similar conditions. Thus, it cannot be said from my experience that the age and sex of a patient with pain in the back or leg is of any aid in the differential diagnosis of a herniated lumbar disk.

Table 1. *Sex and Age Incidence.*

Series	Sex		Age								
	M	F	1–10 yr.	10–20 yr.	20–30 yr.	30–40 yr.	40–50 yr.	50–60 yr.	60–70 yr.	Lowest yr.	Highest yr.
Proved herniations	58	20	0	2	11	29	26	7	3	17	67
Similar conditions	31	10	0	0	5	13	16	7	1	26	66

Etiology

Table 2 shows the comparative figures for the type of injury, including the number and percentage of injuries received in industry. Certain of these findings should be emphasized. For example, it was as usual for a herniation of a lumbar disk to develop in the absence of any history of injury as it was for it not to do so. This agrees with the findings of Bradford and Spurling.[10] Love,[11] however, states that there is usually a history of trauma or unusual stress or strain to the back. Lifting strain was twice as frequent a cause of herniation as of similar conditions, back injuries were three times as frequent, and falls were one and a half times as frequent. The incidence of industrial cases for each type of injury was approximately the same in both series except that all the cases with similar conditions caused by lifting strain were industrial whereas only three quarters of the cases with herniation from the same cause were industrial. There were no postoperative cases in the proved series, and there was no significant difference in industrial distribution between the two series as a whole. Other things being equal, a history of a lifting strain, a back injury or a fall weights the diagnostic scales in favor of a herniation as against similar conditions. A complete absence of a history of injury neither favors nor militates against a diagnosis of herniation. The relation to injury in industry is of no diagnostic significance.

Table 2. *Etiology.*

Type of Injury	Proved Herniations				Similar Conditions			
	Total no. of cases	Percentage of group	No. of industrial cases	Percentage of industrial cases	Total no. of cases	Percentage of group	No. of industrial cases	Percentage of industrial cases
No injury	8	10	0	0	5	12	0	0
Automobile accident	3	4	0	0	4	10	0	0
Fall	19	24	10	52	7	17	4	57
Lifting strain	20	26	15	75	5	12	5	100
Back injury	17	22	11	65	3	7	2	67
Postoperative	0	0	0	0	12	29	10	83
Change of position	5	6	3	60	2	5	1	50
Others	6	8	0	0	3	7	0	0
Totals	78		39		41		22	
Percentages				50				53

Time Relations

In Table 3 are analyzed the intervals elapsing between the first attack of pain and hospitalization and those between the start of the attack that led the patient to seek relief at the Boston City Hospital. These figures are neither helpful nor significant from the point of view of differential diagnosis. They do demonstrate, however, the extraordinary length of time that a patient is willing to suffer before seeking or consenting to hospitalization.

Symptoms and Signs

The foregoing are more or less routine considerations in the analysis of any such series. The analysis of subjective symptoms and objective signs (Tables 4 and 5) is of more interest and significance. The subjective symptoms of pain have been analyzed in some detail because pain is unquestionably the most significant symptom of herniated lumbar disks. The first attack of pain occurred most frequently in the back, where a disk had herniated or was about to herniate or where some similar condition was present or was about to develop (Table 4). The difference in frequency is not great and is probably not significant diagnostically, the frequency being only 10 per cent higher in the proved disk cases than in the other conditions. The number of cases in which pain was absent in the back at the first attack but occurred instead in the leg or legs, including the hip and thighs, should be noted. The

patient's description of the location of the pain during the course of the disease pointed to the leg, exclusive of the foot, as the preponderant location, and to the lower leg as the most frequent site. This applies to both series. The infrequency with which the foot and especially the toes are involved is in disagreement with the usual description of the symptoms of herniated lumbar disk. There is nothing in these figures that is otherwise of aid in the differential diagnosis of herniation. The pain when present was most frequently described as a constant severe ache and was often associated with subjective numbness. Intermittent pain during the attack was only about one third as frequent as the constant type in both series (Table 5). In 64 per cent of the proved herniations there was a history of recurrent attacks of pain, as compared with 33 per cent in the other series. Pain was increased by coughing, sneezing or straining in 63 per cent of the proved herniation series, as against 40 per cent in the other series, and exercise was more frequently mentioned in the nonherniated series as causing increased pain. As would be expected, rest and orthopedic treatment were the most effective means of decreasing the pain in both series. From these data it seems reasonable to conclude that a history of recurrent attacks of pain in the lower back and leg, which occur first as pain in the low back and are increased by coughing, sneezing or straining and relieved by rest or orthopedic treatment, is somewhat more indicative of a herniation of a lumbar disk than it is of any similar condition. Subjective symptoms as described by the patient appear to be of no value in identifying the level at

TABLE 3. *Interval before Hospitalization.*

LENGTH OF INTERVAL	PROVED HERNIATIONS				SIMILAR CONDITIONS			
	FROM FIRST ATTACK TO HOSPITALIZATION		FROM FINAL ATTACK TO HOSPITALIZATION		FROM FIRST ATTACK TO HOSPITALIZATION		FROM FINAL ATTACK TO HOSPITALIZATION	
	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage
Less than 1 wk.	0	0	0	0	1	2	2	5
Less than 2 mo.	4	5	22	28	4	10	11	27
Less than 7 mo.	27	35	64	82	10	24	23	56
Less than 1 yr.	39	50	72	92	17	41	27	66
Less than 2 yr.	45	58	78	100	20	49	31	76
Less than 5 yr.	54	69	—	—	31	76	36	88
Less than 10 yr.	63	81	—	—	34	83	—	—
10 yr.	3		—		—		—	
12 yr.	3		—		—		—	
13 yr.	—		—		2		—	
15 yr.	2		—		1		—	
17 yr.	1		—		—		—	
22 yr.	1		—		—		—	
23 yr.	1		—		—		—	
24 yr.	—		—		1		—	
26 yr.	1		—		—		—	
No pain	—		—		1		1	
Not given	3		—		2		4	
Totals	78		78		41		41	

TABLE 4. *Data on Subjective Pain.*

DATA	PROVED HERNIATIONS	SIMILAR CONDITIONS	DATA	PROVED HERNIATIONS	SIMILAR CONDITIONS
Site of first attack of pain:			Site of pain during hospitalization:		
Back	56	25	Low back	57	28
Leg or legs	14	3	Gluteal region	11	5
Back and legs	2	4	Leg:		
Hip and thigh	9	4	Thigh	28	10
Abdomen	2	1	Upper leg	29	17
Sciatic nerve	3	0	Posterior thigh	23	12
No pain	0	3	Posterior lower leg	26	11
Not given	2	1	Lower leg	43	17
			Knee	12	5
			Ankle	15	9
Kind of pain:			Foot:		
Paresthesia	16	1	Foot	13	6
Numbness	32	15	Little toes	8	1
Hypesthesia	3	2	Great toe	2	1
Causalgia-like	1	0	Sole	2	0
Ache	20	30	Abdomen	1	2
Stabbing	14	9	No back pain	20	10
Severe	62	28	No leg pain	1	6
Mild	0	8	No pain	0	3

which the disk is ruptured, provided such a rupture is present.

The results of certain objective tests are listed in Table 6. No claim is made that they are completely accurate, and it is impossible to prove that the figures might not have been different had the tests been done by other examiners. I believe, however, that whatever error exists is not large enough to be significant. Attempts to be too meticulous and to ascribe too great a significance to variations that arise primarily out of the examiner's desire to bolster a preconceived diagnosis may be a source of error. This is not without importance, because there is no doubt that the majority of these patients first come for diagnosis to the general surgeon and not to the specialist. The demonstration of borderline sensory changes, for example, may depend quite as much on the examiner as on the patient, and an ankle jerk that is considered diminished by a general surgeon will be recognized by the neurologist as normal and only apparently changed because of the method of its elicitation. So, too, whereas an orthopedic surgeon will measure the amount of straight-leg raising in degrees, the more usual interpretation is covered by the terms "present" and "absent." This more liberal and possibly less exact method of listing the results of these tests is more suited to the present knowledge of the condi-

TABLE 5. *Data on Subjective Symptoms.*

DATA	PROVED HERNIATIONS	SIMILAR CONDITIONS	DATA	PROVED HERNIATIONS	SIMILAR CONDITIONS
Frequency of pain:			Cause of decreased pain:		
Constant	36	24	Walking	3	2
Occasional	2	3	Standing	1	0
Intermittent	10	8	Sitting	2	10
Attacks of pain:			Lying	26	13
Recurrent	49	13	Back motion	0	0
Constant	29	26	Exercise	1	1
Not noted	1	2	Rest	1	—
Cause of increased pain:			Local applications	0	—
Cough and so forth	45	14	Heat	3	—
Walking	4	17	Cold	0	—
Standing	14	14	Baking and massage	2	—
Sitting	18	8	Drugs	1	—
Lying	13	3	Osteopathy	1	—
Back motion	42	22	Orthopedic treatment	24	15
Exercise	12	21	Others	4	3
Lifting	8	9	No decrease	0	6
Orthopedic treatment	2	0	No pain	0	3
No increase	3	2	Not noted	23	5
No pain	0	3			
Not noted	7	4			

TABLE 6. *Data on Objective Signs.*

DATA	PROVED HERNIATIONS			SIMILAR CONDITIONS			DATA	PROVED HERNIATIONS			SIMILAR CONDITIONS		
	POS.	NEG.	NOT GIVEN	POS.	NEG.	NOT GIVEN		POS.	NEG.	NOT GIVEN	POS.	NEG.	NOT GIVEN
Objective sensory changes:							Low-back signs:						
Buttocks	5	61	2	3	33	5	Abnormal position	40	36	2	20	21	0
Anal region	2	64	2	2	34	4	Muscular spasticity	45	28	5	22	19	0
Thigh	16	50	2	7	29	5	Change in lumbar curve	33	41	4	19	21	1
Lower leg	27	39	2	11	25	5	Limitation of motion	47	28	3	21	20	0
Foot	22	44	2	9	26	6	No low-back signs	15	0	0	14	0	0
Great toe	7	59	2	2	33	6	No note	0	0	1	0	0	0
Little toes	7	59	2	5	30	6	Sciatic-nerve stretch tests:						
Sciatic nerve	2	0	0	0	0	0	Lasègue	22	10	46	6	3	32
Anesthesia, hyper- and hypesthesia in L4, L5 and S1 areas	8	0	0	8	0	0	Straight-leg raising	51	9	18	20	8	13
None	28	0	2	17	0	5	Tests causing increased intracranial pressure:						
Objective motor signs:							Coughing	39	6	32	11	14	16
Weakness of legs	25	53	0	13	28	0	Compression of jugular vein	2	0	76	0	0	41
Paralysis of legs	0	78	0	5	35	1	Local low-back, lumbosacral or sacroiliac tenderness	41	20	17	20	20	1
None of either	0	53	0	0	27	0	Visceral disturbances:						
Atrophy of legs	10	68	0	2	39	0	Bladder difficulty	3	75	0	4	37	0
Babinski sign	0	78	0	2	39	0	Bowel difficulty	0	78	0	4	37	0
Reflexes*:							Both bladder and bowel difficulty	0	78	0	4	37	0
Knee jerk	4	74	0	9	32	0							
Ankle jerk	33	44	1	15	26	0							
Others	0	77	1	0	41	0							

*Under reflexes, "positive" indicates an abnormal reflex, "negative" a normal one.

tion in question. Attempts to be more accurate are analogous to figuring percentages in groups of two-digit numbers to six decimal places; the one is no more diagnostically significant than the other is mathematically so. It is for this reason that in this study the sciatic-nerve stretch tests, the objective sensory changes and other signs, the reflex response and similar reactions are noted only as being present or absent or normal or abnormal.

FIGURE 1. *Positive Anteroposterior and Lateral Roentgenograms after Lipiodol Injection.*

Low-back signs. Spasticity of the lumbar muscles with obliteration or alteration of the lumbar curve and reproduction or accentuation of pain by pressure lateral to the spinous processes is, according to Bradford and Spurling,[10] of particular diagnostic importance in differentiating a herniation from similar conditions. The figures in the present series support these contentions feebly if at all (Table 6). In particular it should be noted that exclusive of local tenderness no back signs were demonstrable in one fifth of the proved herniations and in one third of the similar conditions. Local tenderness was present in half of the latter as opposed to slightly less than two thirds of the former. As differentially diagnostic signs they had no significant value in this series.

Straight-leg raising and the Lasègue tests. These tests, particularly the former, are generally considered to have a considerable differential diagnostic

TABLE 7. *Data on Objective Findings in Cases of Proved Herniation.*

Disk Level and Number of Cases	No. of Cases	No Objective Sensory Changes	Sciatic-Nerve Stretch Tests									Reflex Changes					Objective Motor Changes					
			Lasègue test			Straight-leg-raising test			Both together			Knee jerks		Ankle jerks		Other reflexes	Weakness		Paralysis		Atrophy	
			Pos.	Neg.	N.G.	Pos.	Neg.	N.G.	Pos.	Neg.	N.G.	Pre.	Abs.	Pre.	Abs.	Pre.	Abs.	Pre.	Abs.	Pre.	Abs.	Pre.	Abs.
Third lumbar	4	3(75%)	0	0	4	3	0	1	0	0	1	2	2(50%)	2	2(50%)	4	0	2(50%)	2	0	4	0	4
Fourth lumbar	38	15(39%)	13	6	19	21	6	11	8	5	6	37	1(3%)	26	12(32%)	38	0	12(32%)	26	0	38	7(18%)	31
Fifth lumbar	32	9(30%)	9	3	20	24	4	4	7	3	4	30	2(6%)	16	16(50%)	32	0	10(31%)	22	0	32	3(9%)	29
Fourth and fifth lumbar	3	1(33%)	0	1	2	3	0	0	0	0	0	3	0	2	1(33%)	3	0	0	3	0	3	0	3
Fourth or fifth lumbar	1	1(100%)	0	0	1	0	0	1	0	0	1	1	0	1	0	1	0	0	1	0	1	0	1
Totals	78	30	22	10	46	51	10	17	15	8	12	73	5	47	31	78	0	24	54	0	78	10	68

Abbreviations: "Pos." = positive; "Neg." = negative; "N. G." = not given; "Pre." = present; and "Abs." = absent.

significance, positive tests being considered by many physicians as practically pathognomonic of rupture of a disk. The figures shown here do not bear this out (Table 6). Whereas 85 per cent of the patients with herniations had a positive straight-leg-raising reaction, 71 per cent of the other series had the same sign. Even if the percentages are figured on the basis of either or both tests' being positive, the comparative figures are still 86 and 70 per cent.

conditions. The numbers are too small to permit any conclusions to be drawn in regard to the jugular-compression test, but there is no doubt that it, too, would show similar results. Neither test helps to differentiate a herniation from a tumor of this region. In this instance my figures are in accord with the statements made by Bradford and Spurling.

Objective motor signs. Weakness of the legs occurred in 32 per cent of the cases in each series,

FIGURE 2. *Residual Lipiodol, Injected Elsewhere, before (left) and after (right) Attempts at Removal. This patient had symptoms because of root compression by encysted globules of lipiodol. This was verified by operation.*

From my experience it appears that a positive straight-leg-raising or Lasègue test, whether considered separately or together, only indicates some trouble with the lumbosacral roots or the cauda equina. This trouble may vary from a congenital defect of the spine through a postoperative scar compression of one or more nerve roots to a posterior herniation of a lumbar disk. Doubtless other conditions could be included.

Tests producing temporary increase of intracranial pressure. The only significant figures in this regard are those of the cough test (Table 6). Just as in the history, this test is of considerable differential diagnostic import. Although it was positive in 86 per cent of the proved herniation series, there was a similar finding in only 44 per cent of the similar

whereas paralysis was present so infrequently as to be of no significance (Table 6). There was complete absence of both weakness and paralysis in the same percentage of each group. Atrophy was about three times as frequent in the proved herniation series as in the other series, and a Babinski toe response was present in only 2 cases of the second series. If leg atrophy is present in a patient suspected of having a herniated lumbar disk, the chances based on this finding only are three to one in favor of this diagnosis.

Tendon reflexes. Great diagnostic and localizing importance has been attached to the absence of an ankle jerk as a sign of herniation of a lumbar disk. My figures show that in patients with proved herniation it is slightly more usual to find the ankle jerks

normal than it is to find them absent in either leg (Table 6). Reference to Table 7 demonstrates that in the proved herniation series its presence and absence were of equally little value in helping to determine which if any disk was ruptured. There was an occasional absent knee jerk in both series, but the figures are too few to justify any conclusions.

Objective sensory changes. Just as with the subjective sensory symptoms, the most frequent site for objective sensory changes in proved herniations was in the lower leg, with the foot second (Table 6). This holds true also for the other series, although the preponderance is not so great. The absence of positive findings in the toes and particularly in the great toe is especially remarkable. The contrary has been emphasized many times as an important differential diagnostic finding, but such a conclusion is not justified by these figures. Most important of all is the fact that in 37 per cent of the proved herniations and in 47 per cent of the similar conditions there was no demonstrable sensory loss of any type in the lower extremities. This does not agree with Bradford and Spurling's[10] statement that 75 per cent of patients with herniations have a demonstrable hypesthesia, but is more nearly in accord with Love's[11] experience that neurologic signs are usually minimal, with hypesthesia or anesthesia over a small segment of the surface of the skin. The importance of objective sensory changes is considerably diminished in the light of these figures, whether considered from the point of view of differential diagnosis or from that of localization.

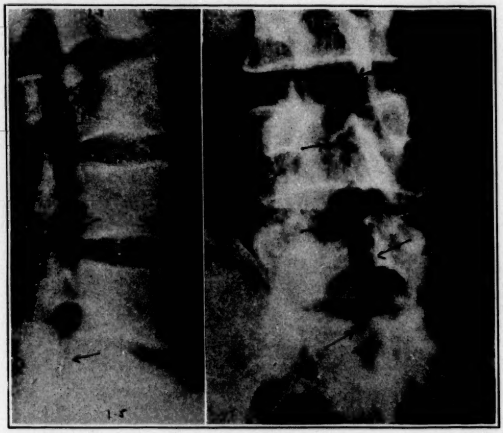

FIGURE 3. *Positive Two-Needle Lateral and Anteroposterior Oxygen Myelograms.*

Level of herniation. In Table 7 are listed certain of the above tests with reference to the particular disk that has been ruptured. Mention has already been made of the high percentage of patients who showed no loss of sensation. This finding occurred at approximately the same rate whether it was the

TABLE 8. *Data on Cerebrospinal Fluids and Myelograms.*

DATA	PROVED HERNIATIONS				SIMILAR CONDITIONS			
	NORMAL	HIGH	LOW	NOT GIVEN	NORMAL	HIGH	LOW	NOT GIVEN
Spinal fluid:								
Pressure	31	4	0	10	34	3	1	3
Total protein	21	16	0	8	23	14	0	4
	NONE	PARTIAL	COMPLETE		NONE	PARTIAL	COMPLETE	
Dynamic block	29	6	0	10	27	8	2	4
	NEGATIVE		POSITIVE		NEGATIVE		POSITIVE	
Serologic reaction	13		0	32	16		0	25
				QUESTIONABLE				QUESTIONABLE
Myelograms:								
Lipiodol	0		9	0	0		3	0
One-needle air	0		9	0	1		1	0
Two-needle air	9		22	6	10		10	2
20% Skiodan	0		17	1	3		9	1

fourth or the lumbosacral disk that had been ruptured. The number of patients with sensory loss in the great or other toes also seems significant from this point of view. Of the 7 patients with involvement of the great toe, 4 showed rupture of the fourth disk and 3 rupture of the lumbosacral disk. Of the patients with involvement of the other toes, 2 had a rupture of the fourth disk, 4 had a rupture of the fifth disk, and 1 had a rupture of the third disk. Loss of the ankle jerk was present in half of the lumbosacral ruptures but in only one third of the fourth-disk ruptures. Weakness was present contradictory, however, when used to differentiate ruptures of the fourth and fifth disks. If the objective sensory changes are in the lower leg or foot, this also increases the chances of a herniation. Absence of any objective sensory changes does not militate against this diagnosis. Spasm of the back muscles, abnormal postures, changes in the lumbar curve, loss or diminution of back motion, local tenderness anywhere in the lumbosacral area and a positive straight-leg-raising or Lasègue test are no more characteristic or diagnostic of a posterior herniation of a lumbar disk than they are of any

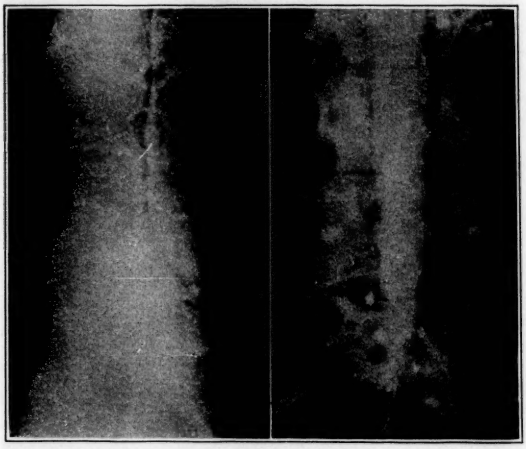

FIGURE 4. *The Normal Lumbosacral Subarachnoid Space Outlined by Skiodan. The droplets are from a previous Lipiodol injection done elsewhere and remaining after removal of the bulk of the oil.*

to an equal degree at both levels, but atrophy was twice as frequent with rupture of the higher of these disks. There was no significant difference between the levels in the rate of occurrence of either the positive Lasègue or the positive straight-leg-raising test. On the basis of this series the only objective test with any significant localizing value regarding the level of rupture is absence of the ankle jerk on the affected leg. The presence of atrophy may be of some localizing value.

It seems only reasonable to conclude from these figures that a patient who has an onset of sciatic pain or who has that pain increased if it is already present, by any test that increases the intracranial pressure has a slightly better than two to one chance of having a herniated disk as the cause of his pain if he has no intraspinal tumor. If he has an absent ankle jerk and atrophy of some of the muscles of the affected leg, his chance of having a herniation is slightly increased. These two tests are mutually other of a variety of low-back, lumbosacral-root or cauda-equina diseases or injuries.

Cerebrospinal-fluid data. As has been repeatedly emphasized, alterations in the pressure, dynamics and total protein content of the cerebrospinal fluid below the level of a herniated lumbar disk are no more characteristic of this condition than they are of any other condition that interferes with the circulation of the fluid. Love[11] differentiates herniations and tumors on the basis of total protein content, claiming that values over 100 mg. per 100 cc. usually mean a neoplasm. The present series of conditions similar to herniated disk contained only 1 patient with a tumor. This tumor did not cause a block and the protein content was below 50 mg. It is impossible to draw any conclusions about this particular differential diagnostic problem. I am in complete agreement with Love, however, on the basis of other experience that in "unexplained intractable root pain and in almost every

case in which protruded intervertebral disk is suspected diagnostic lumbar puncture should be performed." In so far as my figures go, the cerebrospinal-fluid pressure, dynamics and total protein (Table 8) were of no help in making a differential diagnosis of posterior herniation of a lumbar disk.

Myelography. Almost everyone concerned with the problem of diagnosing and treating posterior herniations of the lumbar disk admits that visualization of the lumbar and sacral subarachnoid space is a highly desirable diagnostic prerequisite. Most of this group would also agree that it is an essential if it can be done easily, comfortably and safely and if the degree of accuracy approaches perfection. One has only to refer to the long-continued use of admittedly unsatisfactory mediums and the number and persistence of the attempts that have been made to find a satisfactory one to verify this impression. Of the media commonly in use, lipiodol certainly affords the best contrasts (Fig. 1). It is an oily solution, however, and as such may lead to false positives through partial emulsification when mixed with the watery cerebrospinal fluid. Examinations made with it have to be done with the aid of a fluoroscope and by a roentgenologist capable of operating this apparatus. It is irritating and has to be removed by a second procedure, which, although done easily by some, is of some magnitude in the hands of most surgeons (Fig. 2). Pantopaque, the use of which has until recently been limited almost entirely to the medical departments of the Army and Navy, is the next best medium, but except that it is much less irritating and does not have to be removed, it has the same disadvantages that lipiodol has. The use of oxygen and air presents considerable technical x-ray difficulty, and the percentage of unsatisfactory films and wrong diagnoses is admittedly too high. In addition, the examination must be made with the feet higher than the head, and this position must be maintained for twenty-four hours or longer if post-lumbar puncture headache, which may be extremely severe, is to be even partly avoided. To be sure, a fluoroscope is not required, the gas absorbs itself, and there is little or no meningeal irritation. Two lumbar punctures are required to get the greatest number of satisfactory visualizations (Fig. 3).[12] Thorotrast and iodine in poppyseed oil have also been used, but the former is considered too dangerous and the latter does not provide adequate contrast, so that their use has been abandoned.

For the most part we have used air by a two-

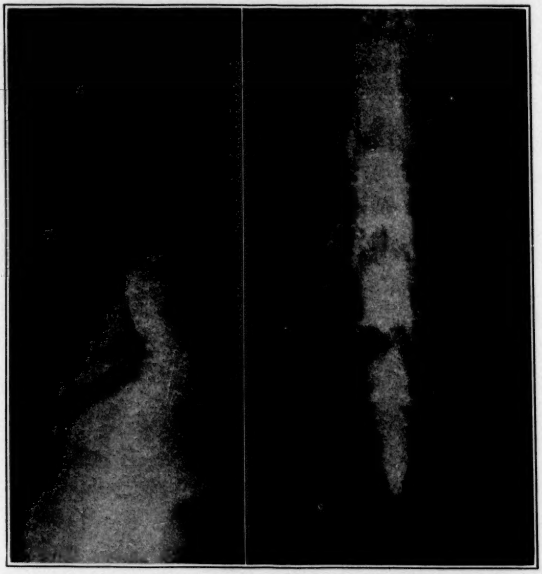

FIGURE 5. *Positive Lateral and Anteroposterior Skiodan Myelograms that Show Filling of the Subarachnoid Sleeves Around the Roots.*

needle technic as a contrast medium (Table 8). Until the present manpower shortage affected the supply of skilled x-ray technicians and dark-room workers a fairly satisfactory level of accuracy could be maintained. This was never considered an ideal medium, however, and in the last two years or more it has hardly met minimal requirements. As will be seen from Table 8 about 30 per cent of the examinations were either wrong or not usable for diagnostic purposes. About one and a half years ago, my then resident, Dr. Philip R. Vogel, suggested the use of Skiodan intrathecally as a contrast medium. Before leaving for service in the Army he had completed sufficient preliminary work to demonstrate that a 20 per cent solution of Skiodan could be used in this way with safety and with an inconsequential amount of meningeal irritation, provided spinal analgesia — not anesthesia — was first produced (Fig. 4). The injected material was completely absorbed in two hours, and the contrast obtained was as good as or better than that obtained by lipiodol. The use of a fluoroscope was not necessary. Since the technic required making the test with the patient's head elevated, it was thought that the chance of demonstrating borderline herniations was better than with any other method. Individual fibers of the cauda were outlined and the subarachnoid root sleeves were constantly visualized around every root (Fig. 5). Lateral views were equally satisfactory (Fig. 6). The clinical work was then stopped until animal experimentation could verify the safety of the material. This has now been done and recently further more exact and more detailed clinical tests have been carried out as well. An extended report of this work, including a description of the method, will shortly be submitted for publication. On the evidence collected so far it appears to me and my co-workers that a 20 per cent solution of Skiodan satisfies all the requirements postulated above as necessary to justify the routine use of a contrast medium in the diagnosis of posterior herniation of the lumbar disks. Even were this not so, however, such diagnoses can usually be made with the aid of one of the less satisfactory mediums, and a diagnosis without that aid does not give the patient the full benefit of the surgeon's knowledge and diagnostic opportunities.

Conclusions

A clinical history and examination that even include a study of the cerebrospinal fluid are not enough to justify an indisputable diagnosis of posterior herniation of a lumbar disk. An unequivocal recommendation of surgery as a method of treatment is equally unjustifiable under such circumstances. If, however, one can demonstrate a sensory deficit that corresponds to the peripheral distribution of a low lumbar or upper sacral root, together with atrophy and loss of ankle jerk in the same leg, a diagnosis of irritation or compression of this particular root is justified.

If in addition there is a history of intermittent attacks of pain in the back with radiation to any part of the leg, especially to the lower leg, which is associated with initiation or increase of the typical pain by coughing, sneezing or straining, or by back motion or lifting, and if these attacks started after a back injury, back strain, lifting strain or fall, a posterior herniation of either the fourth lumbar or lumbosacral disk must be seriously considered as a cause of the radiculitis. This cannot be regarded as anything approaching a certainty, however, unless

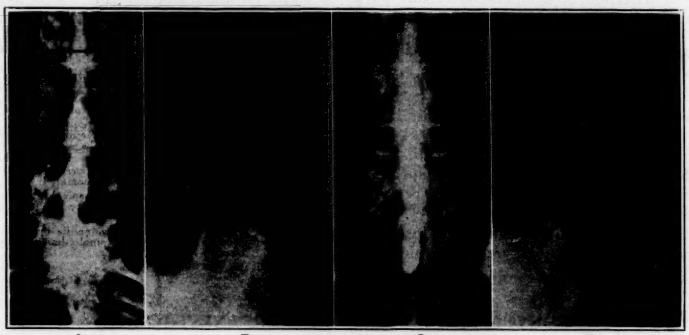

Figure 6. *Positive Skiodan Myelograms.*

A and B are anteroposterior and lateral views showing a typical deformity at the level of the fifth lumbar intervertebral disk. C and D are anteroposterior and lateral views of the same patient eight months after removal of the disk. There was a compression radiculitis caused by postoperative scarring, with recurrence of the original symptoms; this was verified by operation.

confirmed by other and more accurate data. Additional symptoms and signs, whether present or absent, neither strengthen nor weaken this possibility. A positive straight-leg-raising or Lasègue test, limitation or loss of back motion, a change in the lumbar curve, spasm of the erector spinae muscles and local tenderness in the lumbosacral area indicate only that the patient has some trouble with his low back, lumbosacral roots or cauda equina and neither confirm nor deny the diagnosis of a herniation.

A history and examination such as given above, if accompanied by a partial or complete dynamic block or an increase in the total protein of a sample of cerebrospinal fluid properly collected from below the level of the block, or both of these, justify a diagnosis of irritation or compression of any part or all the cauda equina and a probable diagnosis of either an intraspinal tumor or a midline posterior herniation of a lumbar disk. Final differentiation must at least await myelography, and in many cases operation.

The level of herniation, if one is present, is usually not determinable on the basis of pure clinical data, and it is entirely out of the question to diagnose and to localize multiple herniations without adequate actual preoperative visualization of the lower subarachnoid space.

Certain diagnosis, both concerning the presence of a herniation or herniations and concerning the level, depends on adequate visualization of the lumbosacral subarachnoid space by some opaque contrast medium. So far, a 20 per cent solution of Skiodan has proved satisfactory for this purpose.

Clinical examinations lay the groundwork for suspecting the presence of a posterior herniation of a lumbar disk. Contrast myelography proves or disproves this suspicion, determines the level of the herniation, and leads to a minimal amount of surgery, should this be indicated.

References

1. Magnuson, P. B. Differential diagnosis of causes of pain in lower back accompanied by sciatic pain. *Ann. Surg.* **119**:878-891, 1944.
2. Larmon, W. A. Anatomic study of lumbo-sacral region in relation to low back pain and sciatica. *Ann. Surg.* **119**:892-896, 1944.
3. Caldwell, G. A. Spondylolisthesis: analysis of fifty-nine consecutive cases. *Ann. Surg.* **119**:485-497, 1944.
4. Dandy, W. E. Newer aspects of ruptured intervertebral disks. *Ann. Surg.* **119**:481-484, 1944.
5. Keegan, J. J. Neurosurgical interpretation of dermatome hypalgesia with herniation of lumbar intervertebral disc. *J. Bone & Joint Surg.* **26**:238-249, 1944.
6. French, J. D., and Payne, J. T. Cauda equina compression syndrome with herniated nucleus pulposus: report of eight cases. *Ann. Surg.* **120**:73-87, 1944.
7. Oppenheimer, A. Pathology: clinical manifestations and treatment of lesions of intervertebral disks. *New Eng. J. Med.* **230**:95-106, 1944.
8. Breck, L. W., Hillsman, J. W., and Basom, W. C. Lumbosacral roentgenograms of 450 consecutive applicants for heavy work. *Ann. Surg.* **120**:88-93, 1944.
9. Shinners, B. M., and Hamby, W. B. Results of surgical removal of protruded lumbar intervertebral disks. *J. Neurosurg.* **2**:117-122, 1944.
10. Bradford, F. K., and Spurling, R. G. *Intervertebral Disc.* First edition. 158 pp. Baltimore: Charles C Thomas, 1941.
11. Love, J. G. Differential diagnosis of intraspinal tumors and protruded intervertebral discs and their surgical treatment. *J. Neurosurg.* **1**: 275-290, 1944.
12. Munro, D., and Elkins, C. W. Two-needle oxygen myelography: new technique for visualization of spinal subarachnoid space. *Surg., Gynec. & Obst.* **75**:729-736, 1942.

CONVULSIONS DURING GENERAL ANESTHESIA

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THE development of a convulsion in a patient while under general anesthesia is indeed a harrowing experience. Approximately 200 cases have been reported since 1927, but before that time, for some unexplained reason, there appears to have been little on the subject in the literature. Apparently the earliest report is that of Patch.[1] Later, Taylor[2] recounted a case of convulsions under ether anesthesia occurring in the late eighteen-forties. It was not until 1927, however, that general interest became manifested in the condition following publication of the papers of Pinson,[3] who attributed the attacks to excessive concentrations of carbon dioxide, and of Wilson,[4] who believed that impurities in the ether were responsible.

The older term "ether convulsions" is inappropriate since these attacks have been described as occurring as well under anesthesia employing nitrous oxide and oxygen, chloroform, vinethene, ethylene and cyclopropane. The attack itself almost uniformly commences with twitchings about the eyelids or face or neck muscles and rapidly spreads to the entire body, with generalized and violent clonic convulsive movements. There have been no reports of one development under these circumstances, namely, that of extreme hypertension, to be described below.

A great deal has been written in an attempt to explain the cause of this phenomenon. Lundy[5] listed thirty-three possible causes mentioned in the literature, none of these being entirely satisfactory. In fact, there is nothing but contradiction throughout the literature on the etiology of this condition. One of its curious features, as pointed out by Durrans,[6] is that whereas a few authors have described a series of several cases, many surgeons and anesthetists have never seen a single case.

Many consider anoxemia to be the cause, but Goodman and Gilman[7] deny this, stating that the attack may occur in the presence of a high oxygen tension in the blood. Newman[8] cites an author who stated, "Increased vascularity of the cortex cerebri,

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more particularly of the Rolandic area, produced by histamine effect, is the underlying cause."

The idea that aldehydes and peroxides present as impurities in ether may cause convulsions, held by earlier writers, is now known to be untrue.[9] Further, this contention cannot hold when convulsions develop with the use of agents other than ether.

Many other etiologic factors have been proposed, often without any sound foundation. Excess and deficiency of carbon dioxide have been suggested, as well as conditions vaguely described as irritability of the nervous system, overbreathing, latent tendency to fits, sex susceptibility and others not worth mentioning. Even a neurotoxin produced by streptococci has been suggested.[10] Certain of the above may possibly influence the development of a convulsion, especially the carbon dioxide content of the blood, but there has not been demonstrated a constant cause-and-effect relation in every case.

There are a few factors, however, that seem to be present in many cases, although not all. These, appearing as a definite undercurrent in most discussions of the problem, are youth, the presence of sepsis with fever, and hot, humid external surroundings. Some have claimed that these convulsions are due to heat stroke. According to Payne,[11] however, edema and hyperemia of the brain, with nerve-cell degeneration as described in heat stroke, have not been observed in anesthetic convulsions. In view of the possibility that heat is a factor, other writers have suggested that the preoperative administration of atropine is deleterious, the drug acting by inhibiting heat loss. Regarding high wet-bulb temperature, it is interesting to note Brennan's[12] statement to the effect that no convulsion occurred in any of five busy theaters after they had been air conditioned six years previously.

These convulsions can appear at any time, and although several authorities have stressed the importance of neurogenic stimuli,[12] with the convulsion commencing at the moment the peritoneum is grasped in forceps or incised, or as soon as there is traction on the viscera, several cases have commenced after the completion of the surgical procedure and the discontinuance of the anesthetic.

Whereas it is well to be aware of the possibly deleterious factors of youth, heat and sepsis, it must be admitted that the etiology of anesthetic convulsions is quite unknown, that their onset cannot be predicted in any case and that the practical problem is what to do about them.

The mortality rate is 20 to 25 per cent. Death may occur at any time. One of Tye's patients[13] lived for twenty-nine days in a state of decerebrate rigidity without regaining consciousness. That one can survive a violent convulsion has been shown many times, as is illustrated in the case reported below.

The subject of treatment is also somewhat confused. For example, some have claimed to have effected cessation of the convulsion merely by raising the head, and others by elevating the feet. Whereas most writers state that withdrawal of the anesthetic is imperative, Tye[13] believes that deeper anesthesia is needed. My opinion in the matter is the same, but I should accomplish this end by discontinuing the inhalation anesthetic and substituting one of the intravenous barbiturates, either 5 cc. or more of a 2.5 per cent solution of Pentothal Sodium, as recommended by Lundy,[14] or 0.5 gm. of sodium amytal. Should these not be immediately available, intravenous magnesium sulfate may be given, since magnesium is not only a depressant of the central nervous system but also blocks the nervous stimulation of voluntary muscles.[7] In the event of an overdose of magnesium, it is to be remembered that respiratory failure from such a cause is best combated not by the usual respiratory stimulants but by intravenous calcium. Concomitantly intratracheal oxygen should be administered. Of course, the operation should be completed as quickly as possible. For hyperthermia, ice bags placed on the body assist in lowering the temperature. If severe hypertension develops, phlebotomy and drainage of spinal fluid are advisable.

Case Report

R. W., a well-developed and nourished 17-year-old boy, entered the Mercy Hospital on March 18, 1944, complaining of abdominal pain for 24 hours. From the history and physical examination, together with a white-cell count of 22,300 and a rectal temperature of 99.8°F., a diagnosis of acute appendicitis was made. The patient was given 11 mg. of morphine sulfate and 0.4 mg. of atropine sulfate. Forty-five minutes later anesthesia with nitrous oxide, oxygen and ether was started.

Whereas the patient came to the operating room feeling apprehensive, the induction was fairly smooth, and at the beginning of the operation 15 minutes later the patient was well relaxed and showed the ordinary signs of anesthesia, with good color, the pulse, respirations and blood pressure (130/70) being within normal limits. Through a McBurney incision a gangrenous retrocecal appendix was found and freed with some difficulty, during which there was considerable tugging on the cecum. As the appendix was freed, and just prior to removal, the anesthetist noticed twitchings of the neck muscles, and 30 seconds later these became generalized. The convulsion lasted for 35 minutes. As soon as the twitching became generalized and violent, the surgeon who was assisting left the operative field to deal with the emergency, while with the help of the scrub nurse I proceeded with the removal of the appendix and the wound closure, this being accomplished with considerable difficulty, since the patient was making violent convulsive movements.

The pupils were widely dilated during the convulsive seizure. The blood pressure during most of the time was too high to be recorded. The highest systolic record was 280, and the diastolic pressure at that time was 130. During this interval the pulse rose to 160 to 180 and the rectal temperature rapidly rose to 104°F. As soon as the convulsion started oxygen was given under pressure and was continued until the attack ceased. A phlebotomy was performed, 600 cc. of blood being removed, and then 50 cc. of 50 per cent glucose solution and 20 cc. of 10 per cent magnesium sulfate were administered intravenously. As soon as the wound was closed, the patient was rolled on his side and 15 cc. of spinal fluid was removed; it was not under

increased pressure. Sodium amytal was called for, but was not available.

At the end of the convulsion, ice bags were applied and the temperature started to drop, as did the pulse and blood pressure. The last blood pressure reading in the operating room, 20 minutes after the convulsion ceased, was 165/85. The blood pressure continued to drop, and 1 hour later it was 90/28. At that time 250 cc. of plasma and 5 cc. of coramine were given. The blood pressure rose rapidly to within normal limits, and thereafter the patient continued to show steady improvement. He regained consciousness only slightly more slowly than one would expect of a patient who had received a general anesthetic, and by morning showed no neurologic changes and felt well. The only complication was a small wound abscess, which healed rapidly. The last blood pressure reading, taken on the 16th postoperative day, was 120/78. Two months postoperatively the patient was back at work as a surveyor feeling quite well.

The anesthetic consisted of a small amount of nitrous oxide and about 45 cc. of ether, which seemed to be tolerated well. The spinal fluid showed a weakly positive Pandy reaction, a protein level of 30 mg. per 100 cc., a normal cell count, a negative Wassermann reaction and a colloidal gold curve of 2211100000.

It was impossible to determine a cause-and-effect relation in this case. There is no explanation for the rise in the blood pressure to so high a level, much higher than that seen after violent physical exertion or even after therapeutic convulsions.[15] Probably the duration of the convulsion had a great deal to do with the high readings. Perhaps the blood pressure mounts to high levels in such cases and has not happened to be recorded.

As for the increase in body temperature, this could have come about as the result of the muscular exertion. Perhaps, however, the temperature rose during the early part of the operation, unknown to us, and after reaching a certain level contributed to the development of the convulsion. In any event, this case illustrates how complete recovery may follow such a violent episode. It is impossible to state to what extent the intravenous glucose and magnesium sulfate assisted in recovery.

For an extensive bibliography on the subject of anesthetic convulsions the reader should consult the article by Ray and Marshall.[9]

Summary

Convulsions occurring during general anesthesia are not rare, and may occur with the use of any general inhalation anesthetic.

The etiology is unknown, although youth, the presence of fever and hot, humid external surroundings may be important factors.

The mortality rate is 20 to 25 per cent.

Treatment must be immediate and energetic, the use of oxygen and intravenous barbiturates being particularly important.

That one can survive a violent convulsion and extreme hypertension without aftereffects is shown by the case reported.

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References

1. Patch, H. H. L. Notes on two cases of epileptiform convulsions during anaesthesia. *Lancet* **2**:813, 1922.
2. Taylor, M. R. Ether convulsions. *Brit. M. J.* **2**:996, 1937.
3. Pinson, K. B. Convulsions occurring during surgical anaesthesia. *Brit. M. J.* **1**:956-958, 1927.
4. Wilson, S. R. "Ether" convulsions. *Lancet* **1**:1117-1119, 1927.
5. Lundy, J. S. Convulsions associated with general anesthesia. *Surgery* **1**:666-687, 1937.
6. Durrans, S. F. Convulsions under anaesthesia. *Brit. M. J.* **2**:228, 1941.
7. Goodman, L., and Gilman, A. *The Pharmacological Basis of Therapeutics*. 1383 pp. New York: The Macmillan Company, 1941.
8. Newman, S. Convulsions associated with general anesthesia: report of three cases. *Virginia M. Monthly* **68**:655, 1941.
9. Ray, B. S., and Marshall, V. F. Convulsions during general anesthesia: report of 12 cases. *Ann. Surg.* **118**:130-148, 1943.
10. Rosenow, E. C., and Tovell, R. M. Etiology of muscular spasms during general anesthesia. *Am. J. Surg.* **34**:474-485, 1936.
11. Payne, R. V. Ether convulsions. *Guy's Hosp. Rep.* **86**:461-475, 1936.
12. Brennan, H. J. "Ether convulsions." *Brit. M. J.* **2**:765-767, 1941.
13. Tye, J. P. Convulsions of anesthesia. *South. M. J.* **35**:339-343, 1942.
14. Lundy, J. S. *Clinical Anesthesia: A manual of clinical anesthesiology*. 771 pp. Philadelphia: W. B. Saunders Company, 1942.
15. Cleckley, H., Hamilton, W. P., Woodbury, R. A., and Volpitto, P. P. Blood pressure studies in patients undergoing convulsive therapy. *South. M. J.* **35**:375-381, 1942.

GIANT CALCULUS OF THE APPENDIX

Report of a Case

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THERE are few reported cases in the medical literature of the formation of large calculi in the appendix. The two largest appendiceal calculi known are the one reported by Packard[1] in 1921, measuring 1.0 by 2.0 by 4.0 cm., and the one reported by Bunch and Adcock[2] in 1939, measuring 2.75 cm. in each direction. The calculus in the case reported here also measured 2.75 cm. in diameter. So far as can be determined, these 3 cases are the only ones of true calculi of such large size found in the appendix.

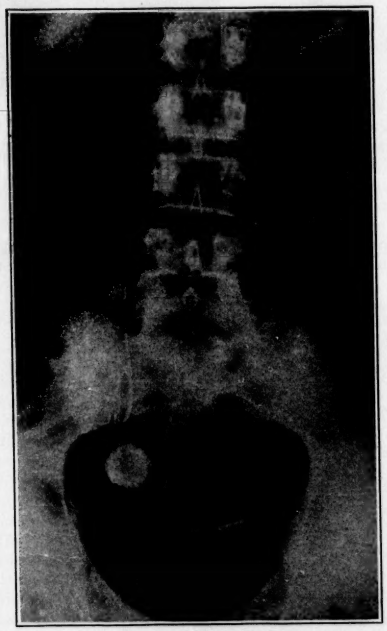

FIGURE 1. *Roentgenogram of Abdomen, with a Catheter in the Right Ureter, Showing the Large Calcified Mass in the Right Pelvis.*

The mechanism of calculus formation in the appendix is probably similar to that in the gall bladder, with chronic partial obstruction of the appendix, stagnation of the retained appendiceal secretions and gradual formation and calcification of the mass centering around a dried-out fecal concretion. The rarity of fully formed calculi in the appendix may be due to the fact that in most cases the irritation and obstruction produced by the original fecal concretion set up a circulatory disturbance in the appendix, resulting in strangulation and gangrene at an early stage before a calculus has a chance to form.

The history of the case reported below was particularly interesting because there were so few early symptoms in spite of the fact that the calculus must have been forming in the appendix for a long period of time.

CASE REPORT

H. S., a 34-year-old man, entered the Newton Hospital complaining of pain in the lower back and the right lower quadrant of the abdomen for 2 weeks. The pain in the back was dull and steady, and on subsequent questioning the patient admitted that he had had some pain in that region for a long time, but this was mild and was always attributed to fatigue. The pain in the abdomen, which was what brought him to the hospital, was intermittent, with recurrent, severe, colicky exacerbations. Between the attacks of colic the pain was dull and constant. During the 2 weeks of acute symptoms, there were considerable anorexia and some nausea, but no acute vomiting.

Physical examination on admission revealed slight localized tenderness in the right lower quadrant but no protective spasm. The blood and urine were normal. Since the history was highly suggestive of a right ureteral calculus, cystoscopy and pyelograms were done. These showed a large calcified shadow several centimeters in diameter in the right pelvis adjacent but anterior to the right ureter (Fig. 1). There were several other calcified shadows higher in the right abdomen. A diagnosis was made of calcified, mesenteric lymph nodes. It was believed that the large calcified shadow in the right pelvis was probably also a calcified node, which because of its large size was causing the pain. Operation was therefore advised,

At operation, while waiting for the anesthetist to put the patient in Trendelenburg position, it was decided to look at the appendix. When the appendix was delivered, it was at first thought that it contained a mucocele, and it was difficult to believe there was such a large stone present until the appendix had been opened. The illustrations (Figs. 2, 3 and 4) indicate better than any verbal description the size, character and location of the calculus.

Further exploration of the abdomen showed many large calcified lymph nodes in the mesentery of the cecum and the ileum, as noted by x-ray. No definite relation could be determined between these nodes and the calculus in the appendix, except that it was assumed that the patient had a greater than average tendency to form calcium deposits. Tests of calcium and parathyroid metabolism showed no abnormality. There was no evidence of bony decalcification. There were no renal or gall-bladder calculi.

The most interesting feature of the specimen was that in spite of the marked distention of the appendix by the stone, which was situated at the proximal end of the appendix and completely obstructed it, there was no enlargement of the tip

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of the appendix and none of the usual changes in the distal half of the appendix that are generally supposed to follow obstruction of the proximal portion. This was undoubtedly due to the fact that how such marked distention and obstruction of the proximal portion of the appendix could have occurred without producing more pronounced symptoms. The only conclusion of general interest to be drawn from this fact is that simple obstruction of the appendix is not by itself the complete answer to the etiology of acute appendicitis.

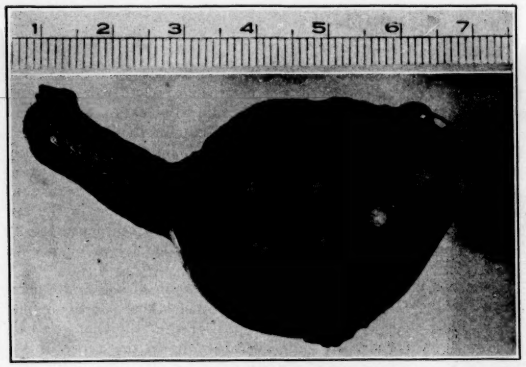

FIGURE 2. *Photograph of the Appendix, with the Calculus Distending the Proximal Half.*

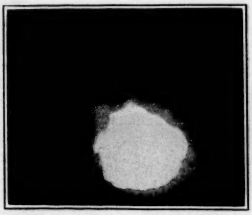

FIGURE 3. *Roentgenogram of the Appendix, Showing the Shadow of the Calculus.*

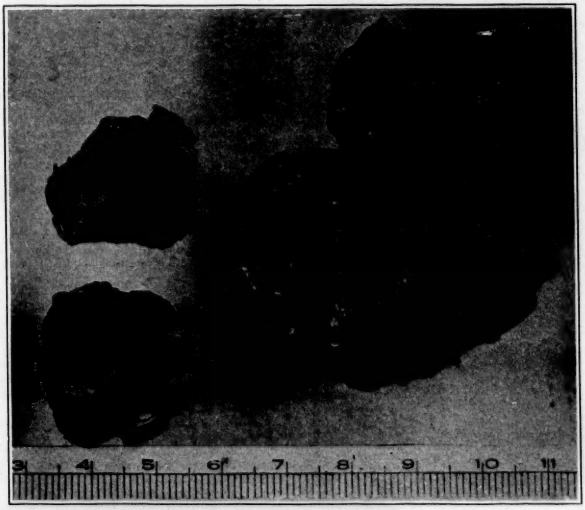

FIGURE 4. *Photograph of the Sectioned Stone and Appendix.*
Note the roughly concentric structure of the stone and the hypertrophied mucosa in the distal half of the appendix.

the calculus enlarged very gradually and caused no acute embarrassment of the circulation of blood or lymph. It is nevertheless difficult to understand

Summary

A case of giant calculus of the appendix is reported. It is believed that this is the third calculus of such size in the appendix to be reported in the literature. This calculus was particularly interesting because it was present in the proximal instead of the distal end of the appendix and caused marked obstruction and distention of the proximal half of the appendix without producing symptoms of appendicitis.

References

1. Packard, H. Appendicular lithiasis: report of case unique in annals of surgery. *Boston M. & S. J.* **185**:656, 1921.
2. Bunch, G. H., and Adcock, D. F. Giant faceted calculus of appendix. *Ann. Surg.* **109**:143-146, 1939.

MEDICAL PROGRESS

ABDOMINAL SURGERY

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ADVANCES in abdominal surgery during the past year have been evaluated. Many of the papers relate to the surgery of trauma and these will not be taken into consideration except when such information may be applicable to problems of civil practice. All reports cannot be included, but many of the timely subjects will be discussed.

General Considerations

Anesthesia

Arrowood and Foldes[1] have modified Lemmon's[2] method of continuous spinal anesthesia. These authors report the use of a continuous-drop method of maintaining spinal anesthesia in approximately 40 cases. A recent personal communication reveals that over 60 patients have been anesthetized by this technic. Anesthesia is established with the usual 2.5 per cent novocain solution intrathecally, and the needle is left in place and connected to a gravity bottle containing 0.5 per cent novocain solution. Depending on the type of patient and the level of anesthesia desired, from 4 to 8 drops of the weak solution is allowed to enter the spinal canal each minute. No complications arose in any case. The maximum duration of anesthesia was six hours, with a total of 150 cc. of the solution used. Approximately 5 per cent of the cases were considered unsatisfactory due to technical errors. The method is particularly suitable for bad-risk patients and is useful when the operation takes longer than planned. The authors found that unanesthetized patients can be given from 12 to 20 drops of physiologic saline solution a minute without ill effect and without a significant rise in the intraspinal pressure; this is twice the rate of administration required for the anesthetic agent.

I have operated on patients under this type of continuous-drop novocain spinal anesthesia. It has definite advantages over the fractional method in that there is no interval between doses. Furthermore, with the latter method the surgeon and the anesthetist are often unaware that the anesthesia has worn off until the patient moves or violently strains or protests. The patient under the new modification remains quiet and comfortable without interruption throughout the procedure.

Early Postoperative Ambulation

This method of handling patients will increase in popularity now that the use of nonabsorbable suture material has been found to result in little or no lag period in wound healing.[3] It appears that fine steel wire, nylon, cotton and silk cause so little reaction in sutured tissues that there is little evidence of the so-called "weak stage" of the suture lines that frequently occurs when catgut is used.

Rickles[4] reports the results on 146 patients observed at the Charity Hospital in New Orleans. Ninety-eight patients without peritonitis were allowed to walk on the first postoperative day following celiotomy. Eighty-seven patients who had had appendectomies through transverse incisions were allowed home on the third day, returning on the sixth day for the removal of sutures. Patients with peritonitis and those in whom the drainage of an abscess was necessary were allowed up after the danger from intraperitoneal inflammation had passed. Patients operated on for inguinal hernia were allowed to walk on the first day postoperative, and those with ventral hernia on the second. All wounds were sutured with cotton, and all healed by primary intention. There were no disruptions, and no hernias developed in the scars during one year of follow-up. None of the patients required catheterization, and only 3 needed enemas.

Powers[5] reports on the advantages of early rising in 100 cases. The results were as good as those in a control group so far as wound healing and lack of complications are concerned. There was no decrease in postoperative thrombophlebitis in his ambula-

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tory cases. He emphasizes the beneficial results of early ambulation and finds no contraindications to its use.

Shorter[6] emphasizes early rehabilitation in abdominal surgery and calls attention to the low incidence of chest complications and the reduction in circulatory disturbances, as well as to the maintenance of muscle and joint tone and the beneficial effect on morale. Patients not suitable for early ambulation were given exercises in bed.

At the Massachusetts General Hospital we have been interested in the good effects of early ambulation, long used in the aged but only in recent years applied to other patients. The danger of wound infection is apparently increased by early rising, but this has not been serious in nature. There appears to be little reduction in thrombosis of the leg veins in ambulatory patients as compared with a control group. So far, there has been no evidence of increased hernia-in-scar, and wound disruption has not occurred. The patient handled in this manner remains in good physical condition and is able to resume his usual activities at an early date.

Sulfonamides

The use of sulfonamides in abdominal surgery is challenged by Rea,[7] who states that a recent review of the literature reveals that many reports are misleading. The experience of the operator using modern methods of preparation, anesthesia and aftercare makes comparative data based on earlier cases open to question. He points out that only alternate cases treated by the same surgeon under the same conditions at the same season of the year with and without sulfonamides would reveal their true value. Experimental work is cited to support the better effect of sulfonamides as a preventive measure to infection rather than a curative one after suppuration has been well established. He was unable to observe that the intraperitoneal use of sulfonamides influences the outcome in suppurative peritonitis of enteric origin in experimental animals, and is of the opinion that pus inactivates the sulfonamide.

It is my opinion that the intravenous use of sulfadiazine is superior in its effect and perhaps safer than the intraperitoneal use of sulfonamides. The former drug can be continued by mouth as soon as adequate fluids can be given by this route. Rare cases in which renal and ureteral crystals are formed must be kept in mind and properly treated.

Glove Powder

Talcum is generally used as a glove powder, but this substance is criticized by Seelig, Verda and Kidd.[8] These authors point out the danger of producing a serious adhesive, granulomatous foreign-body reaction if any talcum powder is allowed to come in contact with peritoneal surfaces. If too much powder is used in the glove and the finger tip becomes punctured, great damage may be done from a small amount of talcum spilled into the peritoneal cavity. They found after much experimentation that a powder (210 to 270 mesh) of potassium bitartrate (cream of tartar) was harmless in the peritoneal cavity of experimental animals. This material shortened the life of rubber gloves by one half.

In trying this substitute for talcum at the Massachusetts General Hospital, we have found that the glove is often sticky and difficult to get on. It seems necessary to find a better powder than potassium bitartrate before it can be satisfactorily used. Until a suitable material can be found, one can either use wet gloves or reduce the danger to a minimum by using talcum sparingly inside the gloves, and washing the outside after putting them on.

Management of Penetrating Wounds

Zinninger[9] gives an excellent outline for the evaluation and management of penetrating wounds of the abdomen. First of all, the degree of shock must be determined, and this combated by plasma followed by blood. Only the patient with obvious continued internal bleeding should be operated on before shock is controlled. The second consideration is the nature of the injury, its extent and the direction of the penetrating missile. This is often best determined by a scout roentgen film if there is no wound of exit. From the location of the foreign body on the film and the point of entry, the structures penetrated can be surmised. The third important observation is whether or not there is evidence of peritoneal irritation. He prefers intratracheal cyclopropane anesthesia and, if the intestine has been penetrated, advises the use of 5 to 10 gm. of sulfanilamide intraperitoneally as well as intravenous sulfadiazine. He is of the opinion that through-and-through closure of the abdominal wall with silver wire is the method of choice in these cases.

Noble[10] proposes an ingenious method of treating old wounds of the small intestine by plication of one loop of gut to its nearest segment. This is carried out through the entire small bowel. He advises hourly doses of Pitressin and claims recovery in 90 per cent of a large series of cases so treated. He believes that local closure of perforations leads to stasis above and between such areas of repair and that the high number of poor results under these circumstances are due to the absorption of toxins from partially obstructed segments of bowel.

One wonders whether this complete plication of the small intestine would be useful in cases of extensive adhesions with repeated episodes of small-bowel obstruction, particularly if the mesentery was such as to lend itself to repeated volvulus.

Small-Bowel Obstruction

Grimson and Hodge[11] corroborate the experience of Folley[12] that Miller–Abbott intubation is often satisfactory as a definitive method of treatment for acute small-bowel obstruction. No time limit need be set for operative interference if the patient does well on the conservative regimen. In 7 cases so treated, 4 were symptom-free from three months to two years without surgery.

It is important to be alert for localized tenderness and maintained or developing leukocytosis, which indicate a gangrenous segment. In my opinion, better results are obtained if surgery is undertaken before gangrenous areas develop or, if already present, before perforation takes place. Equivocal cases should be explored as soon as decompression is under way and the patient's condition is stabilized. The safety of surgery within twenty-four hours after onset, as pointed out by McKittrick and Sarris,[13] cannot be ignored.

Neoplasms of Abdominal Wall

These are discussed by Pack and Ehrlich[14] in a review of 470 cases treated in the Memorial Hospital, New York City. They classify 391 neoplastic lesions as follows: benign neoplasm, 242; primary malignant neoplasm, 63; metastatic malignant neoplasm, 64; and lymphoma, 22. Of the 79 lesions termed non-neoplastic, 24 were cysts, 31 were inflammatory, and 24 were miscellaneous. The lymphatic spread from all neoplasms of the anterior abdominal wall is similar to that of those starting in the umbilical region. Chronic draining sinuses were a frequent source of cancerous degeneration. They call attention to the so-called "Kangri-burn" epidermoid cancer, which is well known in certain Japanese districts where an earthenware bowl containing burning charcoal is worn next to the skin of the abdominal wall as a method of maintaining warmth. Other apparent sources of epidermoid carcinoma were psoriasis, radiation dermatitis and arsenical dermatitis. Of the 63 primary malignant neoplasms, 25 were carcinoma, 30 sarcoma, and 8 melanoma. They also report 17 cases of desmoid tumors and give an excellent description of this pathologic process. Many of their desmoids had had inadequate removal elsewhere.

Hernia

Cutler and Scott[15] report 4 cases of acute small-bowel obstruction from transmesenteric hernia observed at the Children's Hospital in Boston. They have collected 46 additional cases from the literature and state that this type accounts for 11 per cent of all intra-abdominal hernias. The mortality in 50 cases was 38 per cent, although 3 of their 4 patients recovered. The majority of these hernias occurred through developmental defects in the mesentery, although a few were thought to be due to inflammatory processes and trauma.

Jens[16] reports a study of 100 patients with strangulated femoral hernia who were admitted to one institution in a five-year period. The average age of these patients was sixty-three years. Two thirds were beyond the sixth decade, and three fourths of the patients were women. Forty-two per cent gave no previous history of hernia. Strangulation was ushered in by pain and vomiting of from three hours' to fourteen days' duration in 84 per cent of the cases. Pain was not admitted by 2 of 3 patients having nonviable bowel. Pain was most frequent in the midabdomen (65 per cent), and in all these cases there was omentum or small bowel, or both these structures, in the sac. Pain at the site of hernia was present in 26 cases. It was low abdominal and colicky in nature in 7 per cent, and epigastric in 4 per cent. Tenderness over the site of the hernia was elicited or recorded in only 21 cases. Seven of the entire group were Richter's hernia. Twelve of 20 cases with gangrenous bowel required resection, with a mortality rate of 66 per cent. Two cases with exteriorized gangrenous intestine died. The over-all mortality for the entire series was 14 per cent.

White[17] calls attention to the satisfactory results obtained from simple herniotomy under local novocain anesthesia in the bad-risk patient with strangulated umbilical hernia. Analysis of records of radical repair as an emergency measure revealed a high mortality rate. The dangers of radical cure in this group of patients as an operation of election are also stressed.

Burton[18] emphasizes the better results obtained by autogenous fascial repair in inguinal hernia. In 385 cases repaired by the Gallie method, there were 0.9 per cent recurrences. In 132 cases repaired by the McArthur method, there were 4.5 per cent recurrences. There were 3 cases of testicular atrophy in the larger group. He depicts an ingenious foot sandal, with a canvas strap attached, to maintain the leg in inversion while the fascia lata is being procured.

Ryan[19] corroborates the results obtained by McCloskey and Lehman[20] in the routine use of the McArthur type of repair in inguinal hernia. He advocates cotton sutures to reinforce the wound and uses the Bisgard needle to carry the fascial strip. Ninety-two cases were followed without evidence of recurrence.

A combination of the McArthur and the Halstead I operations, employing fine silk or cotton sutures, has been the minimum standard repair used in adults on the East Surgical Service of the Massachusetts General Hospital for a number of years. It has given extremely low rates of infection and of recurrence in a large group of patients operated on by the resident staff. Alternate cases have been ambulated on the first postoperative day with no

serious complications and with much less invalidism than that in a control group. The early risers have been kept in the hospital until the tenth postoperative day, whereas those treated for twelve days with recumbency have averaged fifteen days of hospitalization.

Biliary System

White[21] gives an excellent presentation on the differential diagnosis in jaundice. In 175 cases, the proved error in diagnosis was 8 per cent; half these were due to overlooking small or latent tumors. He states that there is too great a tendency to make a diagnosis of portal cirrhosis in the alcoholic patient when the obstruction is actually due to cancer. Partial obstruction proved to be caused by benign lesions in 91 per cent of the cases, and complete obstruction was due to cancer in 96 per cent. This, I believe, is not the generally accepted rule and probably is the result of including a large number of cases of toxic hepatitis and biliary cirrhosis with those of obstructive jaundice. White believes that hurried exploration is seldom justified and that many of the cases can be correctly diagnosed by sufficient time and study. The easiest cases to diagnose were those with toxic and infectious hepatitis, those with complete external obstruction and those with hemolytic jaundice. Patients with multiple lesions, those who were extremely ill and on whom complete study was not possible and those with tumors of the liver and bile passages offered the greatest diagnostic difficulties. Surgery undertaken on the diagnosis of obstructive jaundice in patients suffering from hepatitis gave a high mortality rate.

Benedict[22] has demonstrated the value of peritoneoscopy and biopsy of the liver for diagnosis in equivocal cases. In most cases, the pathologist can make a definite diagnosis of obstructive jaundice or hepatitis from the biopsy specimen. This method should be used earlier and oftener, since the opportunity for radical cure by the Whipple operation in cancer of the ampulla of Vater or head of the pancreas may be lost if delayed too long.

Truesdell[23] routinely palpated the gall bladder in 500 women undergoing abdominal pelvic surgery and found 50 cases of gallstones. A careful review of the history revealed that only 2 of these patients had had no symptoms referable to the gall bladder. Of these 50 patients, 8 died more or less promptly, 6 received immediate cholecystectomy, 12 sooner or later returned for operation, 12 were lost sight of, and 12 remained under observation.

Robertson and Dochat,[24] in a collective review, have challenged the usually accepted viewpoint that women who have borne children are more apt to have gallstones than are spinsters. They estimated that 79.25 per cent of all women have borne children; this figure is practically identical with the percentage of parous women with gallstones reported by thirty-four authors — 79.6 per cent, or 11,154 of 14,016. They admit that gallstones are two or three times as common in women as in men but refute the belief that pregnancy plays any role in their development.

Bearse[25] analyzed 253 consecutive personally treated cases of gallstones. Thirty-nine per cent of his patients had complications from the stones at the time of operation. Twenty-seven per cent had acute inflammation of the gall bladder, including empyema, gangrene and perforation. Twelve per cent had common-duct stones. Four per cent had acute pancreatitis, and 3 patients had carcinoma of the gall bladder. There were 16 postoperative deaths in the series, only 3 of which were attributable to delay in surgical treatment. He deducts that delay may be justifiable in the absence of complications but that when complications arise, prompt treatment is imperative.

Cowley and Harkins[26] found only 25 cases of perforation of the gall bladder in 2750 patients with cholecystic disease treated at the Henry Ford Hospital in Detroit in twenty-two years. They agree that the differential diagnosis of acute cholecystitis without and with perforation is difficult and uncertain. They are of the opinion that operation of election between attacks should be stressed rather than early operation after acute symptoms develop.

Finney[27] analyzed all cases of carcinoma of the gall bladder treated at the Union Memorial Hospital in Baltimore and substantiates the general opinion that all these patients had gallstones. He stresses the danger of advising good-risk patients with gallstones against operation of election, even if their symptoms are minimal. The universally unsatisfactory results of operation after cancer develops strengthen his argument.

Walton,[28] in a fascinating treatise, calls attention to the great importance of careful biliary-tract surgery. Anomalies of the bile ducts and blood supply are far more frequent than usually thought. Injuries due to anomalies or to carelessness often result in fatalities, and when the patient survives, it may be only for a short period of invalidism. He reviews the literature regarding the various methods of re-establishing continuity between the injured bile duct and the gastrointestinal tract. He reports his own experience with a method of a valve-like anastomosis between the hepatic duct and the duodenum. As in practically all other such reports, his results leave much to be desired.

I[29] have recently reported the immediate results of re-establishing continuity between the bile ducts and the gastrointestinal tract by a new method, which was first mentioned in the progress report for 1940. Eight patients have been treated by implantation of the hepatic duct into the distal transected end of the jejunum 30 cm. from the ligament of Treitz. The cut end is inverted, and the anastomosis accomplished over a long, removable rub-

ber tube. Intestinal continuity is re-established by implanting the proximal jejunum end-to-side into the distal limb at a point approximately 18 cm. from the portal fissure. These patients have had no bile leakage at the anastomotic site. There has been less evidence so far of the frequently disabling cholangitis observed after other methods of repair. Theoretically, there should be less chance of cicatricial constriction at the anastomosis and less chance of ascending cholangitis, since the lumen of the gut is large and the peristaltic current is away from the liver ducts. It will require a greater experience and a longer follow-up period to determine the actual advantages of this method, if any.

Best[30] calls attention to the frequency of liver-duct stones that cannot be removed surgically. He states that the incidence of such stones is about 7 per cent of patients with cholelithiasis. Although he fails to discuss the possibility that these stones will spontaneously leave the liver if the papilla of Vater is gradually dilated to a diameter slightly larger than that of the hepatic ducts, he brings out helpful information regarding flushing the biliary system before and after operation. His method is used a few days prior to exploration and about the eighth and fifteenth days postoperatively. The treatment is carried out three days in succession. On the first day, this patient is given 3 tablets of Decholin or Procholin three times a day and at bedtime, 0.6 mg. (1/100 gr.) of nitroglycerin before meals, 30 cc. of pure cream before the evening meal and at bedtime and 8 gm. of magnesium sulfate before breakfast. The second day varies only by substituting 0.6 mg. of atropine sulfate for the nitroglycerin. The third day's regimen is the same as that of the first.

I have found this method of treatment helpful in a few cases of cholangitis following common-duct reconstruction. In one case, it has been continued with more or less regularity three days each week, since symptoms of mild pain, chills, fever and itching recur if the treatment is omitted for any length of time.

Ferguson[31] reports an ingenious method of treating chronic ascites. In a patient requiring frequent paracenteses, one of the two normal kidneys was removed and its pelvis implanted into the peritoneal cavity. This was successful only after the third operation, when the implantation was located behind the lower posterior rectus sheath where it functioned perfectly throughout one year of observation. The two previous attempts at implantation in other locations ceased to function after a while owing to plugging of the ureteral orifice with omentum and so forth. The patient voided the ascitic fluid with the urine secreted by the remaining kidney.

Pickrell and Clay[32] report the successful removal of the left lobe of the liver in 3 patients, one of whom had a primary carcinoma, one a hemangioma, and one a gumma thought at the time of operation to be a carcinoma. They have collected only 56 cases of liver lobectomy from the literature and state that no other author has reported more than a single case.

Ulcer of Stomach and Duodenum

Much has been written about the importance of the ulcer problem in military personnel. Tidy[33] makes an exhaustive report on the situation in the British army. Having analyzed 800 army cases, he found that 58 per cent of all patients admitted with dyspepsia were found to have ulcer. He stresses the need for accurate diagnosis and believes that soldiers with ulcer should have duty compatible with a suitable dietary regimen. Those with functional disorders should be diagnosed early and sent to regular duty before they become neurotic about their symptoms. He states that if the diagnosis of ulcer was incorrectly made on a man with a functional disturbance, it became difficult to overcome this error. He claims that there is no evidence to support the theory that ulcer is more liable to develop in soldiers than in civilians. Eighty per cent of all army personnel having ulcer were found to have had symptoms for an average of seven years, dating back into civil life.

This accurately corresponds with the data on this subject reported by Rush[34] regarding American soldiers in the combat zone. He agrees that soldiers with ulcer are not suitable for combat duty. This is in accord with the report by Logan[35] regarding men in the Navy.

Rook[36] studied this situation in the Royal Air Force. He selected 194 cases and followed them for two and a half years. Only half these men were eventually able to do flying duty. The higher the rank, the more the likelihood that the man would be able to carry on. Of the whole group, two thirds are still in service and one third have been invalided. He claims that neither the length of the history nor any of the criteria of diagnosis appear to offer guidance whether or not an airman after treatment for ulcer is likely to withstand service life.

In 200 dyspeptic soldiers, Guyer[37] compares the diagnosis by means of fluoroscopy and gastroscopy. The findings were normal by both methods in about 40 per cent of the cases. Roentgenologic studies were normal in the cases (nearly 31 per cent) found to have gastritis gastroscopically. Duodenal or gastric ulcer was found by one or both methods in only 16.5 per cent of the group studied.

Spicer, Stewart and Winser[38] report that perforated ulcer increased from approximately 25 to 35 per cent during the London *Blitz*. This fell to normal or below after the air raids ceased. The authors attempt to show the effect of anxiety on ulcer activity. They fail to take into consideration the physical hardships of air-raid shelters, with the almost certain change in dietary habits.

Raw[39] analyzed 1052 cases of perforated ulcer occurring from 1937 to 1941 in England and showed a yearly rise from 181 cases in 1937 to 251 in 1941. The average age of the patients was forty-two years, which was obviously influenced by the younger citizens being in military service. The death rate under the age of forty-two was 7.6 per cent, whereas over forty-two it was 21.3 per cent. He calls attention to the fact that delay in operation was more frequent in women than in men, owing to the fact that in the former the acute onset was incorrectly interpreted as due to gallstone colic. The average delay in the women of this group was eighteen hours, with a shocking mortality rate. The author agrees that the closure should be made as early as possible with minimal surgery and with gentleness but reasonable speed.

Wakeley[40] compares a group of 102 civilians and 103 naval personnel with perforated ulcer. The civilians averaged forty-six years of age, with a mortality rate of 20 per cent, and the naval group averaged thirty-two years of age, with a mortality rate of 8 per cent. He believes that the Royal Navy, having standardized its treatment by immediate gastric suction, early closure and sulfanilamide therapy, may reduce the mortality rate to 1 per cent.

Walters and Butt[41] make a strong plea for radical surgery in the personnel of the United States Navy with duodenal ulcer. They point out that the operative mortality is very low and that 85 per cent of the patients so treated were returned to active duty. A comparable analysis of a much larger group treated medically showed that only 50 per cent were able to return to active duty. These authors believe that many valuable men can be retained in service after proper subtotal gastric resection.

Weinstein et al.[42] have completed some experimental work on animals and operated on 6 patients for ulcer by various incomplete interruptions of the vagus nerves. They have apparently done these operations from below the diaphragm and illustrate how difficult, if not impossible, it is to completely section the vagus nerves by this route. In none of their cases was the secretion of the stomach or the acidity influenced by partial vagotomy.

Dragstedt and Owens[43] have made a preliminary report on transthoracic interruption of the vagus nerves in ulcer of the stomach and duodenum. It appears that their experimental work and early cases have been further substantiated by a later report on 18 clinical cases.[44] In all these, the patients were relieved of their ulcer symptoms and the ulcers were shown by roentgenographic studies to be healed. There seems to be a definite reduction in gastric secretion and acidity after this procedure.

Moore[45] has accomplished transthoracic vagus interruption in 3 patients at the Massachusetts General Hospital. These were carefully selected as desirable subjects for the procedure and were not thought suitable for subtotal gastrectomy. The patients are, at this time, greatly improved and are being carefully followed.

Cancer of Stomach

St. John, Swenson and Harvey[46] examined fluoroscopically 2413 patients beyond the age of forty coming to the outpatient department of the Presbyterian Hospital in New York City for other than gastrointestinal complaints. Three of these were found to have unsuspected malignancy of the stomach — a rate of 1.24 per 1000. In 528, functional and organic lesions other than cancer were discovered. Ninety of these patients had abnormalities within the thorax. The feasibility of this type of examination is discussed. Much depends on the experience of the roentgenologist, and even under ideal circumstances, such studies are unreliable. Many cases of advanced cancer of the stomach have been found within a few weeks after a negative observation. It seems improbable that the high incidence of deaths from cancer of the stomach can be materially lowered by such routine roentgenographic examinations.

Bisgard[47] emphasizes the interrelation of gastric ulceration and cancer of the stomach. The differential diagnosis between ulcer and cancer of the stomach is admittedly difficult and often impossible.[48] Ulcers that appear benign gastroscopically and roentgenologically are often malignant. These lesions appear, at times, to diminish in size, and symptoms improve under treatment, the patient returning, often too late, with obvious cancer of the stomach. The patient with gastric ulcer must be kept under close observation, and delay in surgical interference must be reduced to a minimum. The end results of gastric resection for ulcers that appear benign but prove to be malignant are twice as good as those when the operation is undertaken for obvious clinical cancer. Bisgard further substantiates the fact that gastrectomy is safer for gastric ulcer than for duodenal ulcer and that the results of this type of treatment are more satisfactory than are those of conservative management.

Feldman[49] discusses the life cycle of carcinoma of the stomach. He followed 3 patients over a period of years who had what appeared to be benign gastric ulcer with remissions. Two had relatively low gastric acidity, and the other one had hyperacidity. All these patients eventually developed pyloric obstruction that proved to be due to inoperable cancer of the stomach. He warns against the false security of negative roentgenologic examinations and believes that narrowing of the pylorus may be significant in the absence of a demonstrable tumor. Emphasis is placed on the clinical picture. If the patient is progressively getting worse, frequent observations are necessary until the diagnosis is established.

Intestinal Diverticulums

Warren and Emery[50] found 103 cases of diverticulum of the duodenum at the Peter Bent Brigham Hospital in Boston over a period of twenty-seven years. This represented an incidence of 2.3 per cent of cases showing roentgenologic evidence of gastrointestinal disease. The average age of the patient was fifty-eight years; 39 were in men and 64 were in women, a reversal of the sex ratio for other duodenal lesions. The size of the diverticulum varied from 0.5 to 6 cm. in diameter; 9 per cent were in the first, 65 per cent in the second and 15 per cent in the third portion of the duodenum, the remainder being multiple. They call attention to a false type in the first portion and a true herniation in the second. The authors believe that many of these lesions are symptomless and that other causes for complaint, such as gallstones, ulcer and pancreatitis, should be ruled out. The treatment for the majority of cases is that used for duodenal ulcer. Only diverticulums forming an abscess or failing to empty should be treated surgically.

Pearse[51] presents an excellent description of the surgical management of complicated duodenal diverticulums. He illustrates a method of identifying and preserving the opening of the common bile duct and the pancreatic ducts during the procedure. A portion of the neck of the sac is left, as in operations for esophageal diverticulums, in order to secure an adequate inversion.

Rudder[52] reports an interesting case of acute diverticulitis of the jejunum. His patient was a fifty-six-year-old Costa Rican farmer who gave a history of postprandial pain of two months' duration. He was hospitalized after three days of intermittent colicky nonradiating epigastric pain and vomiting. The abdomen was flat and rigid, without distention or increased peristalsis. The maximum tenderness was in the midepigastrium. The white-cell count rose from 24,000 on admission to 49,100 within a few hours. The maximum temperature was 101.2° F. The preoperative diagnosis was acute cholecystitis with perforation of the gall bladder. A large acutely inflamed diverticulum was found 45 cm. from the ligament of Treitz. This was excised, and the patient recovered uneventfully.

Young and Young[53] discuss diverticulitis of the colon and, by a compilation of statistics, find that 5.2 per cent of 70,572 patients examined by barium enema or at autopsy showed diverticulums. In three series of cases totaling 3915 patients, 34.3 per cent showed inflammation. The majority of patients with diverticulosis can remain symptom free by proper dietary measures and bowel hygiene. They call attention to the apparent transient improvement in symptoms by barium enemas. Approximately 22 per cent of the patients with diverticulitis finally come to surgery for one or more of five reasons, that is, acute perforation with spreading peritonitis, obstruction of the sigmoid, fistula, localized abscess and inability to rule out cancer. They obtained a history of bleeding in 26 per cent of their cases.

Lymphosarcoma

McSwain and Beal[54] studied 20 cases of lymphosarcoma of the gastrointestinal tract entering the New York Hospital during a recent nine-year period. These were distributed as follows: esophagus, 1; stomach, 7; small intestine, 3; appendix, 2; and colon and rectum, 7. There were 13 males and 7 females, with ages varying from four and a half to seventy years, — the average being forty-three years. They point out that the correct diagnosis is rarely made preoperatively. Survival is influenced more by the site and extent of the process than by age or the histologic structure of the tumor. Six patients who had well-localized lesions without involved lymph nodes and were treated by excision alone were alive and free of recurrence from two to seven years. Of the 6 patients treated by radiation alone, only 2 were free of recurrence. Two patients were unable to tolerate roentgen therapy and succumbed before treatment was finished. Of the 6 patients treated by excision followed by radiation, 2 were still free of recurrence. Nine of the 20 cases were free of recurrence from one to nine and a half years after the diagnosis was established. Eight patients succumbed with an average duration of two years of life. The authors believe that the best prognosis is in patients who have lesions suitable for complete excision. Roentgen therapy should be used in all cases in which the surgeon and the pathologist are uncertain that the disease has been completely removed.

Winkelstein and Levy[55] studied 15 cases of lymphosarcoma of the intestines and believe that these tumors arise in the lymph nodes or lymph follicles of the submucosa. The mucosal gland structure is obliterated, and the submucosa and muscularis become invaded, which results in a submucosal tumefaction. Stenosis of the small intestine by the tumor is rare, but intussusception is of common occurrence. Lesions affecting the large bowel are prone to produce obstruction. These authors state that the lymph nodes were involved in all their cases. Distant metastases to the liver, spleen and kidneys occurred rarely. They call attention to a characteristic sigmoidoscopic appearance of the tumor, which appears to resemble the surface of the brain. The average age of their patients was forty-four years, and the prognosis was poor even with the best treatment, which they thought to be a combination of surgery and radiation. The typical picture was a history of distention, colicky pain and a slightly tender movable mass.

Miscellaneous

Kennedy, Dixon and Weber[56] report 11 children from three to fourteen years of age treated for

polyps in the colin at the Mayo Clinic. Symptoms had been present for from ten days to seven years. All had had blood on the outside of the stools or at the end of defecation, this having been observed daily or at intervals months apart. Small amounts of clear or blood-tinged mucus occurred in 5 cases. Pain was absent in 7 cases, and severe in 1. Diarrhea occurred in only 1 patient. Two of the 11 had lesions presenting at the anus, and 6 had lesions that could be seen through the sigmoidoscope. The authors discuss the preparation of the bowel for roentgen examination and believe that the use of castor oil is still the safest and most effective procedure. Barium enemas revealed a single polyp in 9 cases, and three polyps in 2. The lesion in 9 cases proved to be a Grade I adenocarcinoma, and in 2 it was a benign adenoma.

Lichtman and McDonald[57] studied 590 cases of fecal fistula observed at the Mayo Clinic over a period of twelve years. Four hundred and eight patients were treated surgically, with cures in 244. Their best results were obtained by intraperitoneal excision and anastomosis. Closures within the abdominal wall gave a slightly higher mortality rate and 7 per cent less cures. The fistulas hardest to cure were those arising from a tuberculous tubo-ovarian abscess; next were those resulting from diverticulitis; and the third most difficult group were those arising from regional ileitis. The easiest cases to cure were those following operations for appendicitis. The last nearly always heal spontaneously unless some foreign body, such as a bit of gauze or talcum, is present to produce a granuloma.

Keene[58] calls attention to the safety and excellent results obtained by intraperitoneal reconstruction of the bowel following wounds of the colon. Careful preparation of the bowel is carried out before operation. All scar tissue is resected and an end-to-end anastomosis is accomplished, with careful repair of the mesentery. The closed bowel is dropped free into the peritoneal cavity and the peritoneum is closed without drainage. The remaining layers of the abdominal wall are closed forty-eight hours later, according to the method of Coller and Valk.[59]

Stevenson[60] offers a simplification of the basting-stitch technic for aseptic bowel anastomosis. He crushes the bowel with a Payer clamp and places the basting stitch through the crushed area before dividing it. He believes that this results in a smaller diaphragm than the usually practiced Parker-Kerr method.

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References

1. Arrowood, J. G., and Foldes, F. F. Subarachnoid analgesia maintained by continuous drop method. *Arch. Surg.* **49**:241-244, 1944.
2. Lemmon, W. T. Method for continuous spinal anesthesia: preliminary report. *Ann. Surg.* **111**:141-144, 1940.
3. Localio, S. A., Casale, W., and Hinton, J. W. Wound healing—experimental and statistical study: results. *Surg., Gynec. & Obst.* **77**:376-388, 1943.
4. Rickles, J. A. Early postoperative walking following abdominal surgery. *Northwest Med.* **42**:292-294, 1943.
5. Powers, J. H. Abuse of rest as therapeutic measure in surgery. *J. A. M. A.* **125**:1079-1083, 1944.
6. Shorter, A. Early rehabilitation in abdominal surgery. *Lancet* **1**: 243, 1944.
7. Rea, C. E. Use of sulfonamides in abdominal surgery. *Minnesota Med.* **27**:99-102, 1944.
8. Seelig, M. G., Verda, D. J., and Kidd, F. H. Talcum powder problem in surgery and its solution. *J. A. M. A.* **123**:950-954, 1943.
9. Zinninger, M. M. Penetrating wounds of abdomen. *J. A. M. A.* **124**:491-494, 1944.
10. Noble, T. B., Jr. Perforating wounds of intestine; satisfactory method of treatment for wounds more than 24 hours old. *Am. J. Surg.* **62**:50-58, 1943.
11. Grimson, K. S., and Hodge, G. B. Prolonged intubation suction and deferred or delayed surgery in treatment of multiple adhesive obstructions of small intestine. *Surg., Gynec. & Obst.* **78**:316-326, 1944.
12. Folley, J. H. Medical management of intestinal obstruction with special reference to use of Miller-Abbott tube. *New Eng. J. Med.* **228**:606-612, 1943.
13. McKittrick, L. S., and Sarris, S. P. Acute mechanical obstruction of small bowel: its diagnosis and treatment. *New Eng. J. Med.* **22**: 611-622, 1940.
14. Pack, G. T., and Ehrlich, H. E. Neoplasms of anterior abdominal wall with special consideration of desmoid tumors. *Internat. Abstr. Surg.* **79**:177-198, 1944.
15. Cutler, G. D., and Scott, H. W., Jr. Transmesenteric hernia. *Surg., Gynec. & Obst.* **79**:509-515, 1944.
16. Jens, J. Strangulated femoral hernia: review of 100 cases. *Lancet* **1**:705-707, 1943.
17. White, W. A., Jr. Umbilical hernia in bad risk patient. *Surg., Gynec. & Obst.* **77**:514-517, 1943.
18. Burton, C. C. Use of fascial sutures in inguinal hernia. *Surg., Gynec. & Obst.* **77**:530-533, 1943.
19. Ryan, W. J. Living fascial sutures in repair of inguinal hernia. *Surg., Gynec. & Obst.* **77**:535-538, 1943.
20. McCloskey, J. F., and Lehman, J. A. Living fascial suture in repair of large inguinal herniae. *Ann. Surg.* **111**:610-617, 1940.
21. White, F. W. Study of errors in diagnosis of jaundice. *New Eng. J. Med.* **229**:997-1002, 1943.
22. Benedict, E. B. Peritoneoscopy in liver disease. *New Eng. J. Med.* **230**:125-130, 1944.
23. Truesdell, E. D. Frequency and future of gallstones believed to be quiescent or symptomless. *Ann. Surg.* **119**:232-245, 1944.
24. Robertson, H. F., and Dochat, G. R. Pregnancy and gallstones: collective review. *Internat. Abstr. Surg.* **78**:193-204, 1944.
25. Bearse, C. Gall stones: how far may we go in postponing operation? *J. A. M. A.* **124**:497, 1944.
26. Cowley, L. L., and Harkins, H. N. Perforation of gall bladder: study of twenty-five consecutive cases. *Surg., Gynec. & Obst.* **77**:661-668, 1943.
27. Finney, J. M. T., Jr. Cancer of gall bladder. Read before the Southern Surgical Association, Hot Springs, Virginia, December 7, 1944.
28. Walton, J. Reconstruction of common bile duct. *Surg., Gynec. & Obst.* **79**:57-69, 1944.
29. Allen, A. W. Method of re-establishing continuity between bile ducts and gastro-intestinal tract. Read before the Southern Surgical Association, Hot Springs, Virginia, December 7, 1944.
30. Best, R. R. Incidence of liver stones associated with cholelithiasis and its clinical significance. *Surg., Gynec. & Obst.* **78**:425-428, 1944.
31. Ferguson, C. Ascites: operation for its relief: case report. *J. Urol.* **50**:164-168, 1943.
32. Pickrell, K. L., and Clay, R. C. Lobectomy of liver: report of three cases. *Arch. Surg.* **48**:267-277, 1944.
33. Tidy, H. Peptic ulcer and dyspepsia in Army. *Brit. M. J.* **2**:473-477, 1943.
34. Rush, A. Gastrointestinal disturbances in combat area: preliminary observations on peptic ulcer. *J. A. M. A.* **123**:389-391, 1943.
35. Logan, IV. W., and Bransford, P. W. Peptic ulcers in United States Navy. *Ann. Int. Med.* **18**:929-934, 1943.
36. Rook, A. F. Peptic ulcer: prognosis in Royal Air Force patients. *Lancet* **1**:733-736, 1943.
37. Guyer, R. B. Comparison of radiological and gastroscopic findings in 200 dyspeptic soldiers. *Brit. J. Radiol.* **16**:241-246, 1943.
38. Spicer, C. C., Stewart, D. N., and Winser, D. M. deR. Perforated peptic ulcer during period of heavy air-raids. *Lancet* **1**:14, 1944.
39. Raw, S. C. Perforation of gastric and duodenal ulcers. *Lancet* **1**: 12-14, 1944.
40. Wakeley, C. P. G. Late results of perforated peptic ulcer. *Lancet* **1**: 11, 1944.
41. Walters, W., and Butt, H. R. Management of ulcers among Navy personnel. *Ann. Surg.* **118**:489-498, 1943.
42. Weinstein, V. A., Volp, R., Hollander, F., and Jemerin, E. E. Vagotomy in therapy of peptic ulcer. *Surg., Gynec. & Obst.* **79**:297-305, 1944.
43. Dragstedt, L. R., and Owens, F. M., Jr. Supradiaphragmatic section of vagus nerves in treatment of duodenal ulcer. *Proc. Soc. Exper. Biol. & Med.* **53**:152-154, 1943.
44. Dragstedt, L. R. Personal communication.
45. Moore, F. D. Personal communication.
46. St. John, F. B., Swenson, P. C., and Harvey, H. D. Experiment in early diagnosis of gastric carcinoma. *Ann. Surg.* **119**:225-231, 1944.
47. Bisgard, J. D. Ulcer carcinoma problem of stomach. *Surg., Gynec. & Obst.* **79**:673-675, 1944.
48. Allen, A. W., and Welch, C. E. Gastric ulcer: significance of this diagnosis and its relationship to cancer. *Ann. Surg.* **114**:498-509, 1941.
49. Feldman, M. Life cycle of carcinoma of the stomach: report of three interesting cases of carcinoma of pylorus. *Gastroenterology* **2**:60-64, 1944.
50. Warren, H. A., and Emery, E. S., Jr. Duodenal diverticula: with special reference to their symptomatology. *Gastroenterology* **1**: 1085-1092, 1943.

51. Pearse, H. E. Surgical management of duodenal diverticula. *Surgery* **15**:705-712, 1944.
52. Rudder, F. F. Acute diverticulitis of jejunum: case report. *Surgery* **14**:921-923, 1943.
53. Young, E. L., and Young, E. L., III. Diverticulitis of colon. *New Eng. J. Med.* **230**:33-38, 1944.
54. McSwain, B., and Beal, J. M. Lymphosarcoma of gastro-intestinal tract: report of twenty cases. *Ann. Surg.* **119**:108-123, 1944.
55. Winkelstein, A., and Levy, M. H. Lymphosarcoma of intestines: 15 cases; characteristic sigmoidoscopic picture. *Gastroenterology* **1**:1093-1099, 1943.
56. Kennedy, R. L. J., Dixon, C. F., and Weber, H. M. Polypoid lesions of colon of children. *Surg., Gynec. & Obst.* **77**:639-644, 1943.
57. Lichtman, A. L., and McDonald, J. R. Fecal fistula. *Surg., Gynec. & Obst.* **78**:449-470, 1944.
58. Keene, C. H. Reconstruction of wounds of colon. *Surg., Gynec. & Obst.* **79**:544-551, 1944.
59. Coller, F. A., and Valk, W. L. Delayed closure of contaminated wounds: preliminary report. *Ann. Surg.* **112**:256-270, 1940.
60. Stevenson, D. L. Technique for aseptic intestinal anastomosis. *Surg. Gynec. & Obst.* **79**:552, 1944.

CASE RECORDS OF THE MASSACHUSETTS GENERAL HOSPITAL

Weekly Clinicopathological Exercises

FOUNDED BY RICHARD C. CABOT

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CASE 31061

PRESENTATION OF CASE

A fifty-three-year-old toolmaker was admitted to the hospital with substernal pain.

The patient was well until three months prior to admission, when he noted "substernal congestion." This cleared up and he continued to work. About one month later he developed definite substernal pain. Three weeks later he was admitted to another hospital, where all x-ray examinations and studies were said to have been negative. At that time the blood pressure was "elevated." He was told to forget his pain, since no cause for it had been found. The pain continued, however, at irregular times and was not related to meals, exercise or position. It was hard for him to define it more exactly than to say it was bad and that he became fearful that something terrible might happen to him unless it was controlled. He denied cough or dyspnea. He was discharged after a few days, but severe substernal pain persisted. He consulted another physician, who gave him "electrical treatments," which seemed to make him worse. About two weeks before entry he was admitted to another hospital, where roentgenograms and other studies revealed abnormalities that could be responsible for the pain, and he was referred to this hospital for bronchoscopy. He had lost 37 pounds over a period of about three months.

About twelve years before admission he was first found to have slight hypertension. He had been worried about high blood pressure for a long time, since both his parents and two of his grandparents had had it. One brother had died of hypertension and renal failure at the age of forty-four.

Physical examination revealed a healthy-looking man showing evidence of weight loss. There was a slight Horner's syndrome on the left. The thyroid gland was two to three times its normal size, with a nodule on the right; no bruit was audible over it. There was retromanubrial dullness over an area 8 cm. in width, and slight dullness over the left first and second interspaces. Fremitus and breath sounds were diminished over the left upper lobe. The heart sounds were regular and of fair quality. No murmurs were heard. The abdomen was soft, and no masses or organs were palpable. The femoral pulsations were equal. An examination of the larynx revealed paralysis of the left vocal cord and arytenoid.

The temperature, pulse and respirations were normal. The blood pressure was 180 to 210 systolic, 120 diastolic, and equal in both arms.

Examination of the blood showed a white-cell count of 10,900, with 70 per cent neutrophils, 16 per cent lymphocytes, 7 per cent monocytes and 7 per cent eosinophils. The hemoglobin was 13 gm. The urine had a specific gravity of 1.006, with a + test for albumin; the sediment contained occasional red cells, white cells and hyaline and granular casts. The alkaline phosphatase was 6.9 units per 100 cc. A Hinton test was negative. A phenolsulfonephthalein test showed 20 per cent dye output in fifteen minutes and 10 per cent more in thirty minutes.

By the seventh hospital day the pain had increased and required frequent injections of morphine. He said that it radiated to the midback. A fluoroscopic examination showed a pulsating mass continuous with the aorta, but the left diaphragm appeared paralyzed and showed paradoxical motion. On the tenth hospital day the pain was located about both costal margins. On the twelfth hospital day he was in severe pain, sweating and sitting on the edge of a chair; the pain had extended to the left kidney and to a slight degree into the left leg. Films of the chest revealed an area of increased density, extending from the left hilus into the midchest, that could not be separated from the hilus or the descending aorta (Fig. 1). The edge was sharply demarcated, and there seemed to be some atelectasis of the lung around it. The density pulsated with the aorta, but the descending aorta could be traced through it. The left leaf of the diaphragm was elevated and again showed paradoxical motion. The lung fields were otherwise clear.

On the morning of the thirteenth hospital day the patient suddenly coughed up 4 to 8 cc. of blood-

*On leave of absence.

streaked frothy sputum. A few hours later, while lying flat for dorsal-spine films, he suddenly twisted his head to the left, had convulsive movements and became cyanotic and had stertorous breathing. These films showed marked proliferative changes

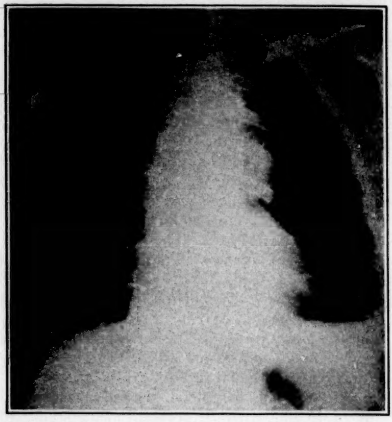

FIGURE 1.

but no definite areas of erosion or destruction. The medial border of the left lung, normally lying close to the spine, was seen to be at least a centimeter away from it. Following this there was paresis of the left side.

During the next few hours he had four or five Jacksonian seizures, beginning on the left side of the face and extending to the left arm, left leg, right arm and right leg. A few were mild and terminated with the left arm. He vomited after one seizure. Between attacks there was weakness of the left arm and leg and he was irrational, restless and noisy. There was some nuchal rigidity. The pupils were equal. The fundi could not be examined. After 400 cc. of blood were removed by venesection, the blood pressure was 130 systolic, 85 diastolic. The femoral and dorsalis-pedis pulsations were equal. A lumbar puncture revealed clear colorless fluid under a high initial pressure. Following the removal of 10 cc. the final pressure was equivalent to 400 mm. of water. The temperature rapidly rose to 105°F., and the blood pressure returned to the original level. The patient continued to cry out because of pain in the back, and the left-sided paresis persisted. He became incontinent and finally died on the fifteenth hospital day.

DIFFERENTIAL DIAGNOSIS

DR. JOSEPH C. AUB: I shall not ask to see the x-ray films because I think that they would probably disclose the diagnosis.

The Horner's syndrome is extremely important if true; but it is never spoken of again, and I should like to be sure that it was really there and not a mere asymmetry.

DR. BENJAMIN CASTLEMAN: Dr. Chapman, will you tell us about that?

DR. EARLE M. CHAPMAN: There was a slight but definite Horner's syndrome.

DR. AUB: With a loss of 35 pounds of weight one has to consider an overactive thyroid gland; there is no suggestion of this except its large size. I think that retromanubrial dullness involves one of the most difficult areas in the chest for percussion, but I shall accept the statement of increased dullness to 8 cm. All the chest findings suggest that this man had collapse of the left upper lobe.

We then learn that he had paralysis of three nerves that can be involved in the mediastinum, namely, the cervical sympathetic nerves, producing a Horner's syndrome, the recurrent laryngeal nerve and the phrenic nerve.

The value for alkaline phosphatase was twice the normal. That is undoubtedly important. One does not usually observe such a finding unless there is some reasonable explanation for it.

The attacks of cyanosis and stertorous breathing were obviously thought to be due to hypertension or to cardiac failure. I do not believe that the rest of the story sounds as if he had a cardiac lesion or cardiac failure. The hypertension was such as might well precede the cerebral attacks that he had. I suppose that is the reason they bled him, but it did little good, as might have been expected.

This is an extremely difficult case. One can argue about many things that this might have been, either in the brain, in the chest or elsewhere. I think on the whole, however, that it is best to discuss only two conditions, — aneurysm of the aorta and carcinoma of the lung, — realizing that by so doing I may completely miss the diagnosis.

Did he have an aneurysm? He had an examination three months before entry and nothing abnormal was found. If he had had an aneurysm it ought to have been observed at that time. The Hinton test was negative. Under these conditions it seems unlikely to me that he had an aneurysm of the syphilitic type, but he might have had a dissecting aneurysm. The pain gradually migrated from the chest to the kidney region and down toward the pelvis, but there is no good evidence of the closing off of any peripheral blood vessels. The whole story seems to me to be much too slow and protracted for that of a dissecting aneurysm, although I admit that dissecting aneurysm appears to be a perfectly tenable diagnosis: the patient had hypertension, he was the proper age, the story is suggestive of the way the usual pain of dissecting aneurysm is distributed, and the clinical course is also suggestive.

Carcinoma starting in one of the main bronchi of the left lung, however, appears to be a much likelier

diagnosis. I should put the neoplasm in the bronchus of the upper lobe.

Three or four months before admission, x-ray studies were negative, which is perfectly all right for a bronchial neoplasm that is concealed in the mediastinum and therefore not seen during fluoroscopy or on the first x-ray plate. The patient then began to have signs of obstruction of the left upper lobe, with atelectasis, and associated with that he began to have signs of a sulcus tumor. He had paralysis of the recurrent laryngeal nerve on the left and paralysis of the diaphragm on the left, all of which suggest invasion of the left mediastinum. This, of course, might have been a lymphangitic type of carcinoma of the lung, in which case I could not differentiate it without seeing the x-ray films. Then the patient coughed up bloody sputum and began to get central-nervous-system signs, which could have been caused by an embolus. An infected cerebral embolus fits in well with the Jacksonian epilepsy and the high temperature. There is no suggestion of anything wrong with the heart, and nothing suggestive of a mycotic aneurysm or subacute bacterial endocarditis. The Jacksonian epilepsy and nerve palsies, however, could also have been due to a silent cerebral metastasis, with hemorrhage into it. One other reason for the diagnosis of bronchiogenic neoplasm lies in the blood phosphatase level, which is double the normal. When a carcinoma of the bronchus breaks into a pulmonary vein, the tumor is distributed all over the body. It not infrequently gets into the bones, where it usually forms an osteoclastic lesion, but there is no reason why there cannot be an osteoblastic reaction, which would give an elevated phosphatase level in the blood.

This man probably had a bronchiogenic neoplasm in the left upper bronchus, with atelectasis and possibly pneumonia or abscess behind it to account for the fever. I think that he also had metastases, probably widespread, involving bone — it is usually in the vertebras, in spite of the negative x-ray evidence — and the right cerebral region, with slight hemorrhage into the latter. I believe that he had contracted kidneys, which produced a urine of low, fixed specific gravity, but that this was of secondary importance.

May I now see the x-ray films?

Dr. Chester M. Jones: Does the fact that pulsation of the dorsalis pedis artery was demonstrated argue against dissecting aneurysm?

Dr. Aub: Yes. I looked throughout the history for evidence of some vessel that was obstructed but could find none.

Dr. Wyman Richardson: My bet is aneurysm.

Dr. Laurence L. Robbins: I appreciate Dr. Aub's confidence in diagnosis by x-ray examination, because differentiation of cancer of the left-upper-lobe bronchus and aneurysm is one of the most difficult to make. I have put up the films that were done elsewhere to show the development of the process. This is a chest examination, which was interpreted as negative. These films were taken approximately one month later, and there has been a definite change, the left diaphragm being elevated. The films that were taken at this hospital demonstrate certain things that may be of help. This is the mass in the medial portion of the left-upper-lung field that was seen and interpreted in various ways. The fluoroscopist said that he was unable to separate it from the hilus or from the aorta. These overexposed films give a rather clear picture of the entire descending portion of the aorta. There is one other finding that may be of some value; that is, you can see a small portion of the septum between the upper and the lower lobes on the left side, and it is definitely anterior to the normal position.

Dr. Aub: What does that tell us?

Dr. Robbins: That the left upper lobe is somewhat decreased in size.

Dr. Aub: You are not so helpful as I thought you were going to be.

Dr. Jones: Does one get laryngeal paralysis from aneurysm? Would that mean infiltration around the nerve.

Dr. Aub: The nerve involvement strongly suggests neoplasm. In fact, these x-ray studies make me disagree with Dr. Richardson.

Clinical Diagnoses

Dissecting aortic aneurysm, with compression of the left-upper-lobe bronchus.
Cerebral hemorrhage, right.
Hypertensive heart disease.

Dr. Aub's Diagnoses

Bronchiogenic carcinoma, left upper lobe, with metastases to mediastinum, bones and right cerebrum.
Atelectasis of left upper lobe of lung (? abscess).
Nephrosclerosis.

Anatomical Diagnoses

Oat-cell carcinoma of the lung, left upper lobe, with extension to the mediastinal structures and pericardium and with metastases to the bronchial, mediastinal and retroperitoneal lymph nodes, adrenal and thyroid glands and vertebral spine.
Cardiac hypertrophy, hypertensive type.

Pathological Discussion

Dr. Castleman: The autopsy on this patient proved that Dr. Aub was correct. This man did have a tumor involving the left upper lobe, most of it extending into the mediastinum. The mediastinal extension and involved mediastinal lymph nodes had invaded the pericardium and surrounded portions of the arch of the aorta, encroaching on the

phrenic nerve. The part of the upper lobe not replaced by the tumor was collapsed.

The tumor involved the bronchus to the left upper lobe and proved to be an oat-cell type of carcinoma, which is prone to surround and invade the bronchial walls with only slight intraluminal tumor, which was true here. As Dr. Aub also predicted, the vertebral spine was practically replaced by tumor and showed a great deal of osteoblastic proliferation and fibrosis, which accounted for the elevated phosphatase.

There were metastases to the adrenal and thyroid glands. The brain showed no evidence of metastasis grossly. There was a hemorrhagic lesion in the left parietal lobe, which I do not suppose accounted for the symptoms. The microscopic sections have not been finished, but grossly it did not look like a metastasis.

DR. AUB: I suppose that the hemorrhage was on a hypertensive basis.

DR. CASTLEMAN: He did have a large heart of the hypertensive type.

DR. CHAPMAN: I want to pay tribute to Dr. Aub for his astute interpretation of the findings, which led to the correct diagnosis. I learned three things from this case that were clinically important. The first is that the nerve paralyses were not caused by a dissecting aneurysm but by the cancer. The second point, which Dr. Aub brought out in interpreting the history, is that the pain was too dragged out and too long to be the pain of a dissecting aneurysm. Dr. Castleman called that to my attention when the case was autopsied. The third point is that the clinical impression should outweigh conflicting x-ray evidence that later comes into the picture.

I started out with a diagnosis of cancer of the upper lobe with obstruction to the bronchus but ended up with a diagnosis of aneurysm. I changed my opinion because when this man was fluoroscoped they said that it was an aneurysm. The appointment for a bronchoscopy was therefore canceled and a definite diagnosis of aneurysm was made. Then the patient was fluoroscoped by Dr. Schulz, who thought that the lesion was cancer; his reasons were that, although he could not differentiate the mediastinal mass, the nerve paralysis, the paralysis of the diaphragm and the separation of the lobe were strongly in favor of cancer of the lung root.

DR. CASTLEMAN: I do not believe that we have ever seen paralysis of a nerve with a dissecting aneurysm. In dissecting aortic aneurysm the aneurysm itself is not particularly large. It is not as a rule a bulbous affair, such as is present in the ordinary syphilitic or arteriosclerotic aneurysm. Occasionally one finds a small hematoma but certainly nothing so large as to affect or infiltrate a nerve. I think that is a good point.

DR. J. H. MEANS: Does a Horner's syndrome occur in aneurysm?

DR. CASTLEMAN: It may be present with a syphilitic aneurysm but not with a dissecting aneurysm.

CASE 31062

PRESENTATION OF CASE

A nineteen-month-old infant was brought to the hospital because of respiratory distress of four and a half hours' duration.

The patient had had a mild cold with no constitutional symptoms for two days. Four and a half hours before admission she developed respiratory distress. This steadily progressed to such an extent that she was brought to the hospital.

Physical examination showed a well-developed, well-nourished, cyanotic infant in acute respiratory distress, gasping for breath. Suprasternal and abdominal retractions were seen with every respiration. The voice was not hoarse. The lungs were clear except for a few coarse and some musical rales audible throughout. The throat was brilliant red. The epiglottis was red and edematous. Examination was otherwise negative.

The temperature was 100°F. (the child had had aspirin); the pulse and respirations were not recorded.

The white-cell count was 25,000. X-ray films of the chest showed a mottled increase in the density of both lower lung fields. The stomach was slightly dilated.

About an hour after admission a 4-mm. bronchoscope was passed down to the trachea with extreme difficulty; the entire mucosa was red. A tracheotomy was attempted, but the patient died about one minute before the tube was inserted.

DIFFERENTIAL DIAGNOSIS

DR. ERNA ANDERSON: We have a story of an infant with acute infection running such a fulminating course that four and a half hours after the onset of symptoms there was extreme respiratory distress with retractions, cyanosis and gasping respirations. Two conditions are brought to mind that might cause this sequence of events, namely, interstitial pneumonia and laryngotracheobronchitis.

Interstitial pneumonia is an infection frequently seen in infants one year of age or younger, but not infrequently seen in this age group. It is characterized by sudden onset of rapidly increasing distress, with dilatation of the alae nasi and retractions, both suprasternal and subdiaphragmatic. The temperature is variable; the fever may be low, or the temperature may be elevated to 102 or 103°F. The respirations are rapid and shallow. The chest is held in an inspiratory position, but the excursions are limited. On physical examination, rales are heard everywhere. The signs are somewhat generalized. This is a condition in which the interstitial tissue of the lungs is involved, being characterized by patchy areas of atelectasis and emphysema. The signs are not constant. The white-cell count may be normal or slightly elevated. A count of 25,000 is rather high.

The other condition, laryngotracheobronchitis, covers a variety of infections. The most frequent is ordinary mother's croup; this occurs usually at night after the child who has gone to bed feeling apparently well awakens with a hoarse barking cough and may show some evidence of respiratory distress. This disease is generally mild; the symptoms usually subside the following day but may recur again at night. There may or may not be an elevation of temperature.

A severer form of this type of infection is the laryngotracheobronchitis characterized by subglottic edema. In this, again, the onset may be sudden. In general the course is less fulminating than that mentioned in the present case, and the child may be in the hospital for a period of hours before the wisdom of tracheotomy is determined. The temperature may or may not be elevated but is usually about 102 or 103°F. The white-cell count may be normal or slightly elevated. Again, I believe that a count of 25,000 is a little high for that type of laryngotracheobronchitis. It occurs in the age group between one and two years, there is usually no dilatation of the alae nasi, and the child is almost always hoarse.

A third type of infection is characterized by edema and swelling of the epiglottis. This is really an epiglottitis rather than a laryngotracheobronchitis. It is usually seen in children over two years of age, but Sinclair,* reporting his experience at the New Haven Hospital, mentions that it may occur in children as young as four and a half months. The onset is characteristic, with sudden symptoms that progress to a point where tracheotomy is necessary for relief of respiratory distress from four to twelve hours after the onset. There is a peculiar gasping type of respiration, with implication of the accessory muscles of expiration, as well as substernal and abdominal retractions. Dilatation of the alae nasi is usually not seen. The chief complaint is sore throat and dysphagia. Probably this child was too young to make such complaints. Since the infection usually occurs in the epiglottis, above the larynx, hoarseness may not be present since the vocal cords may not be involved. There is usually fever of an extreme degree, 103 to 105°F., and marked leukocytosis, which ranges from 15,000 to 40,000. The children are extremely prostrated and show evidence of overwhelming infection, and in severe cases there may be an associated pneumonia.

In the information we have it has not been mentioned whether or not there was dilatation of the alae nasi. I wonder if we can find out about that.

DR. GERTRUD REYERSBACH: There was dilatation of alae nasi.

DR. ANDERSON: That means that there was extreme respiratory distress, probably pneumonic rather than tracheal. May we look at the x-ray films?

DR. BENJAMIN CASTLEMAN: There is no radiologist here.

DR. ALLAN M. BUTLER: The report states: "There is definite increase in density in both lower lung fields. The density is mottled in appearance and possibly represents an aspirated pneumonia. The stomach appears to be slightly dilated."

DR. ANDERSON: There is a hazy increase in the markings, as well as the patchy areas of increased density that are mentioned. I was particularly interested to see if there was any evidence of emphysema. It is not mentioned in the report, nor does it appear so to me in the films. The lung fields are not overly clear, and the intercostal interspaces do not seem particularly widened. The position of the diaphragm is relatively normal rather than depressed as one would expect with emphysema. So I think that we can say there was probably no emphysema. The appearance of the x-ray films is not characteristic of interstitial pneumonia. Although some points favor such a diagnosis, the facts that the throat was brilliantly red and the epiglottis red and edematous make me think that this probably falls into the group of cases in which the infection is in the tracheal tree.

It is, of course, of great practical importance to differentiate interstitial pneumonia and laryngotracheobronchitis. In the former condition the obstruction is in the finer radicles and tracheotomy does not help the symptoms, whereas with subglottic or epiglottic obstruction, improvement of the airway below the larynx relieves the respiratory distress. Apparently the service thought that a tracheotomy would be helpful.

Acute epiglottitis is an infectious disease caused by one agent, *Haemophilus influenzae*, and in the reported cases there has always been an associated bacteremia. In spite of the fact that this child was somewhat young, she probably had that disease. It seems likely that the immediate cause of death was laryngospasm, with failure of respiration due to the obstruction. The explanation for this is unsatisfactory. It is assumed to be on a reflex basis. We know clinically that children with laryngeal obstruction are particularly susceptible to laryngospasm, and we hesitate to perform certain procedures without arrangements for immediate tracheotomy at hand. This applies to a digital puncture for obtaining a blood count, to venous puncture for obtaining blood cultures and to swabbing of the nose and throat for culture; it even extends to precautions that should be taken in examination of the pharynx, in which case it is better to use a finger rather than a tongue stick.

I believe that this child had acute epiglottitis, probably due to *H. influenzae*, with associated bacteremia and bronchopneumonia.

DR. BUTLER: I should like to say that this is an

*Sinclair, S. E. Haemophilus influenzae type B in acute laryngitis with bacteremia. *J. A. M. A.* **117**:170-173, 1941.

excellent example of the type of case that demands immediate diagnosis and immediate tracheotomy. The diagnosis apparently was made when this child entered the hospital, since the Emergency Ward note by the pediatric resident states, "The diagnosis is epiglottitis, probably the influenzal type." A nose-and-throat consultant was called, and the child was immediately transferred to the Massachusetts Eye and Ear Infirmary for tracheotomy.

DR. JACOB LERMAN: I should like to ask whether intubation is a practice here rather than tracheotomy.

DR. ANDERSON: I do not believe that intubation is done. At any rate in this case intubation was contraindicated because the obstruction was high and the epiglottitis would still have caused obstruction after intubation.

DR. BUTLER: The real therapy is immediate tracheotomy. The diagnosis can usually be made instantly if the physician thinks of the possibility. The history and the clinical picture are typical. The findings, particularly the large, cherry-red, swollen epiglottis, are practically diagnostic.

DR. ANDERSON: I should like to say that in the reported cases there have been three or four in which recovery has been accomplished without tracheotomy, but all these patients were over five years of age.

DR. CASTLEMAN: Do they give serum or sulfonamide therapy?

DR. ANDERSON: Serum has been given only in the cases in which the infection was overwhelming. Patients in whom tracheotomy is not warranted usually get along well on sulfadiazine.

CLINICAL DIAGNOSES

Acute epiglottitis (*H. influenzae*).
Septicemia (*H. influenzae*).

DR. ANDERSON'S DIAGNOSES

Acute epiglottitis (*H. influenzae*).
Septicemia (*H. influenzae*).
Bronchopneumonia.

ANATOMICAL DIAGNOSES

Acute epiglottitis (*H. influenzae*, Type B).
Septicemia (*H. influenzae*, Type B).
Interstitial pneumonia.

PATHOLOGICAL DISCUSSION

DR. CASTLEMAN: The autopsy findings on this child were exactly as Dr. Anderson predicted. There was a marked inflammatory reaction in the epiglottis, which was edematous and fiery red. Microscopic examination showed an extreme degree of inflammation, with polymorphonuclears, practically an abscess, involving the epiglottis. Strangely enough there was relatively little infiltration in the main bronchi, but microscopic sections of the lungs showed a definite infiltration around the smaller bronchioles throughout the lung with lymphocytes, monocytes and a few polymorphonuclears. Therefore, I shall have to make an additional diagnosis of interstitial pneumonia, although it had not progressed sufficiently to give areas of atelectasis and emphysema, such as one usually sees.

A culture of the epiglottis was taken during life but had not been reported by the time the patient died; it yielded *Haemophilus influenzae*, Type B. The spleen was enlarged and showed evidence of acute splenitis.

DR. REYERSBACH: Culture of the heart's blood at autopsy also showed *H. influenzae*?

DR. CASTLEMAN: Yes.

DR. ANDERSON: Did you culture the lungs?

DR. CASTLEMAN: No.

DR. ANDERSON: Sinclair reports that *H. influenzae* was cultured from the lung in some cases that had failed to show pneumonia microscopically, but I suppose that this might be explained on the basis of a positive blood culture.

DR. CASTLEMAN: The pneumonia that one observes in this condition is not the type in which the alveoli are filled with exudate; the infiltration is around the bronchi in the interstitial tissues.

DR. CHESTER M. JONES: The lungs might yield a positive culture in the absence of pneumonic consolidation if the disease process were very early, death occurring before the pneumonia had developed.

DR. ANDERSON: That is what Sinclair attributed the positive cultures to.

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NONESSENTIAL NURSING

In most departments of social activity it is possible to distinguish between what is essential to the war effort and what is not — especially now that our needs and deficiencies have become so plain. To separate essential from nonessential nursing, however, is a difficult and highly professional matter.

Registered nurses are employed by many physicians for more or less routine office work. Furthermore, there always have been people who indulged themselves unnecessarily in hospital and nursing service; this was an easy thing to do for anyone who could pay his bills, and money is freer now than it ever was before. Luxuries in other fields have been abolished or rationed, but every practicing physician knows that the abeyance of psychoneurotic complaints that characterized the English blitz of 1940 has no counterpart here.

Some trades and professions have been hit harder than others by the changes of war, but one after another they have managed to meet their national obligations when the squeeze came. The nursing profession is now caught in one of these pinches, and we are beginning to see such headlines as "46 Nurses Care for 1689 Wounded." Although most physicians realize that statements of this sort are misleading, since they do not take into account the service given by medical corpsmen, the War Manpower Commission states that 10,000 nurses are urgently needed, and it has been determined on the basis of registered-nurse populations that Massachusetts should supply 969 of these. The Massachusetts Committee for Nurses of the Procurement and Assignment Service has worked hard and long, classifying and reclassifying the women who should be able to meet this crisis. Many who are believed by the committee to be available, however, continue to do what is obviously nonessential nursing. How many registered nurses in doctors' offices are doing work that could not be equally well handled by a medical secretary? How many patients are hospitalized unnecessarily? How many nurses could be freed if their use in private cases were limited to those in which they are really essential?

The first question can be answered only by physicians, and the remedy, if needed, can only be supplied by them. The other questions are being asked by many, and will become more and more widespread as the months of 1945 pass. The Boston City Hospital has begun its answer by insisting that all requests for the assignment of special nurses pass through the hands of the senior visiting physician or surgeon. Other hospitals might follow, or might use other methods. Whole wards for civilian patients might well be closed. Elective surgery might be banned for the duration. For these or for other methods of meeting this emergency the action that will effectively answer the question *must* come from physicians. Every nurse works under a doctor's supervision — and must work with

his tacit approval, not only of her knowledge and skill but also of her very employment.

When the questions reach the ears of the public, the answers will have to be those that the public dictates. The doctors should begin to frame answers that are not equivocal. Until the war is over, physicians should *not* employ nurses in their offices if the work can be done by others, civilians should *not* go to hospitals simply because they can have their bills paid, and private nursing care should *not* be permitted unless the patients are critically ill. These are the answers that the public should and will demand.

CANNED HEALTH BROADCASTS

TRUE to the concept that health is a public commodity and that its promotion and preservation should be under the stewardship of the medical profession, the Bureau of Health Education of the American Medical Association offers a new public-address service to state and local medical societies. It has long been a function of the bureau to furnish scripts to be delivered as speeches by local physicians or to be used as rewrite material, but the supply of available local speechmakers is running short. The doctors, interested as they may be in education of the laity, have been forced to streamline their activities; the care of sickness has become a more pressing problem than instruction in the preservation of health.

The new service of the bureau consists, up to the present time, of four series of electrically transcribed radio broadcasts for use in broadcasting to the public and one series for use in connection with health teaching in elementary schools. Complete sets of the records for public broadcasting are available to medical societies as a free loan service, the cost being only that of shipping; the "Health Heroes" set for school use is offered for sale only, at a cost of $25 per set of twelve programs. In order that this set can be used, the school must have a broadcasting system or a portable record player, or arrangements must be made with a local radio station.

It is reassuring, in these days of social and political unrest, when no one knows what the future may hold for any of us, to realize that our youthful parent society stands squarely behind a policy of public information. It is further to be expected that when a sound system of medical socialization is presented, organized medicine will back that, also, with a right good will.

NOTICES

TUFTS MEDICAL ALUMNI LECTURE

The annual alumni lecture will be given at Tufts College Medical School on Wednesday, February 28, at 4 p.m. Dr. James W. Manary will speak on the subject "The Roads — New and Old."

Physicians and students are cordially invited to attend.

GREATER BOSTON MEDICAL SOCIETY

A meeting of the Greater Boston Medical Society will be held in the auditorium of the Beth Israel Hospital on Wednesday, February 21, at 8:15 p.m. There will be a symposium on recent advances in endocrinology.

PROGRAM

Thiouracil in Thyrotoxicosis. Dr. E. B. Astwood.
Gynecologic Endocrinology. Dr. George Van S. Smith.
Pediatric Endocrinology. Dr. Richard Wagner.

NEW ENGLAND ROENTGEN RAY SOCIETY

The next meeting of the New England Roentgen Ray Society will be held at the Harvard Club of Boston on Friday, February 16. There will be an x-ray conference at 4.30 p.m. At 8:00 p.m., Dr. Henry L. Jaffe will speak on the subject "Osteoid Osteoma."

HEALTH-OFFICER FELLOWSHIPS

The Commonwealth Fund, of New York City, has recently announced the provision of six fellowships for the training of health officers. All applicants must possess a medical degree, have had at least one year's internship and have shown ability together with interest in and aptitude for public health, men who have had at least a few months' experience in actual public-health work being preferred. Applicants without any experience in public health must have exceptional ability, and if awarded a fellowship, will be provided a full calendar year so that they may have opportunity for some field training either before or after their course of study. Applicants who have not attended a school of public health will be preferred, and the fellowships will be awarded for one school year, except as indicated above. Applicants who have attended a school of public health for one year will be considered for a second year, for the doctorate, provided there are available fellowships. The stipends will be $175 to $200 a month for single men and $200 to $250 a month for married men, depending on circumstances, plus tuition and travel from home to school and return.

Application blanks and further information may be obtained from the Division of Public Health, Commonwealth Fund, 41 East 57th Street, New York 22, New York.

SOCIETY MEETINGS AND CONFERENCES

CALENDAR OF BOSTON DISTRICT FOR THE WEEK BEGINNING THURSDAY, FEBRUARY 15

FRIDAY, FEBRUARY 16

*9:00–10:00 a.m. Dwarfism. Dr. Nathan Talbot. Joseph H. Pratt Diagnostic Hospital.

10:50 a.m. Use of Antibiotics in Dermatology. Dr. G. E. Morris. (Postgraduate clinic in dermatology and syphilology.) Amphitheater, Mallory Building, Boston City Hospital.

SATURDAY, FEBRUARY 17

*10:00 a.m.–12:00 m. Medical staff rounds. Peter Bent Brigham Hospital.

(*Notices continued on page xix*)